THE FOUNDRY

Volume 53
Number 17

CLEVELAND, OHIO, SEPT. 1,. 1925

Published
Semimonthly

Writing Made Easier By Aid of Castings

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Portion of Stenographic Room in One of The Large Banks of the Central West

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Find Where Castings Can Be Sold.

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Making Castings *for* Lighting Fixtures

Large Connecticut Manufacturer of Lighting Fixtures Operating a Small Brass Foundry at a Loss Recently Enlarged the Foundry, Installed Modern Equipment and Methods, and Now Is Operating the Department at a Substantial Profit

By Herbert R. Simonds

Fig. 2—Foundry Skill Is Required in Making Lighting Fixtures

USE of electricity as a means of illumination has made rapid strides during the past ten years, this method now being adopted in a majority of homes throughout the country. Scarcely a town is so small or remote that it lacks a central electric generating station or does not receive current over tranmission lines from neighboring stations. Demand for electric fixtures has followed closely on the heels of the wiremen, who have carried electricity to the farm and the summer home, to the pioneer's dwelling in the far Northwest, and to the old colonial houses in New England.

The electric light in the home has developed gradually from a pure utility into a decorative feature as well. The drop cord with a bulb attached today seldom is seen in the home, even in rural districts. Ornamental fixtures more and more are coming into popular use, and most of these fixtures require foundry castings in their construction.

The plant of the Miller Co., Meriden, Conn. is producing 1,500,000 electric fixtures a year in approximately a thousand different styles, and the problems of design and of foundry work in connection with this production, as may be imagined, are highly complex. It has taken many years to build up the present Miller Co. organization. The company first was established in 1844, and was incorporated in 1866 to make oil burners. From that time on, the history of the company parallels the development of home illumination. For many years the whale oil lamps made by this company were popular throughout New England. Then the products of the company followed through the kerosene burners, gas lamps and fixtures, to the modern table lamp such as shown in Fig. 2. Today the company employs two artists who do nothing but work on new designs on decorative lamps. These artists make plaster models from which bronze molds are cast. These molds in turn are used to cast the fixtures.

Most of the highly ornamental fixtures are made of a special metal originated by the company. This metal is said to be considerably harder than spelter, but melts at a comparatively low temperature and is suited to slush casting, this method having been found to be the least expensive and most satisfactory in ornamental fixture work.

Rings, loops, canopies and many

FIG. 1—THOUSANDS OF FIXTURE PARTS ARE CAST EACH DAY IN THE SLUSH MOLDING DEPARTMENT

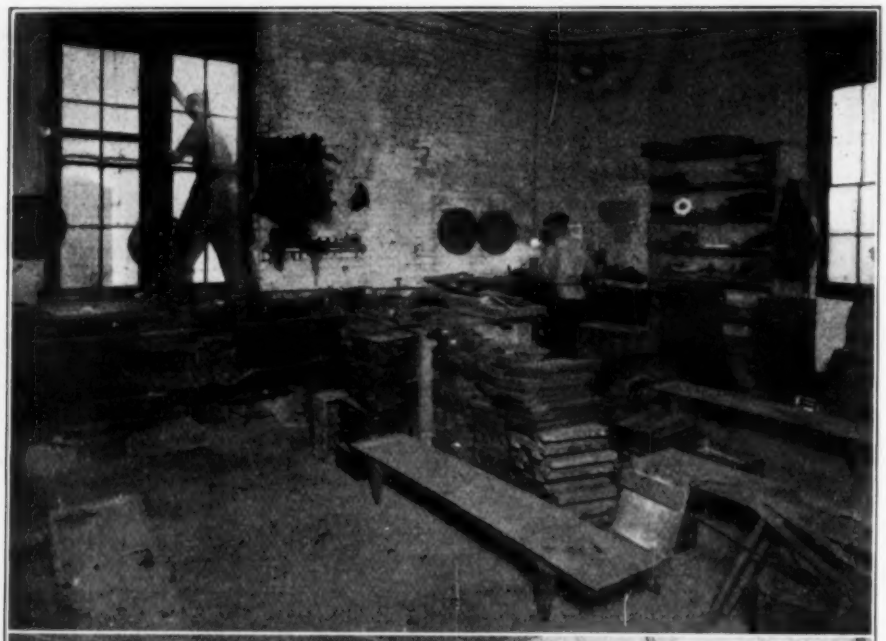


Fig. 3—View of the Old Foundry. Fig. 4—The Foundry After the Improvements Were Made. Fig. 5—The Core Room Is Located Under the Foundry

other parts and fixtures are made of brass castings at the Miller plant. The lamp shown in Fig. 2 is made from two castings made from the special metal and a brass socket casting. The molds for the special metal castings are made of bronze and as a great number of new designs constantly are required, the production of these molds alone is a fairly large foundry problem.

The slush casting department is engaged exclusively on lighting fixture work. When once the bronze patterns are made up, the work of slush casting appears like a fairly simple procedure. Fig. 1 is a view along one side of the slush casting department. Each caster has a pot of molten metal at constant temperature conveniently located at his right. When his mold is ready he takes up a ladleful of this metal, pours it into the mold through a gate left in the pattern, tilts the mold back and forth just the right amount to properly coat all interior surfaces, and then pours the excess metal which has remained in liquid form out through the gate. Thus he obtains a hollow casting without using cores. While the process looks simple, it takes long experience to make the walls of the casting uniform throughout and of the desired thickness. Castings produced in this way almost uncannily are exact in weight, and on some work limits to within a small fraction of a pound are required and maintained merely by the sense of time and feeling of the caster.

After the surplus liquid metal is poured out, the clamps on the mold are taken off, the mold is opened up, and the casting removed. The various parts of the mold then are cooled in a water tank at the operator's left and are ready for assembling in preparation for the next casting. The process is rapid and on a casting such as that shown in Fig. 2 one man will turn out 100 a day.

Production of standard types of fixtures at the Miller plant is heavy as already suggested. On one type of kitchen fixture the sales department called for a production of 1500 complete units per day. This means 1500 castings turned out in the slush casting department. The plant superintendent had ten dupli-

cate sets of bronze molds made to get this heavy production and then required 150 pieces a day from each of the ten casters. Slush casters usually are recruited from the molders and at the Miller plant they received the same pay as the molders working in the brass foundry of the plant.

The Miller Co. has a policy of making practically every item entering into the manufacture of lighting fixtures within its own plant. Thus, in one department glass shades are formed, colored and baked. Silk shades, tassels and cords are made in another department, and in a department of a widely divergent nature brass plate is rolled from ingots.

Canopies and many other parts entering into complete lighting fixture units are made from sheet brass. In another department electrical work required in certain types of fixtures is taken care of. The painting and finishing department is an extensive one occupying one entire wing. Fig. 12, which is taken in this department, gives a good idea of one of the

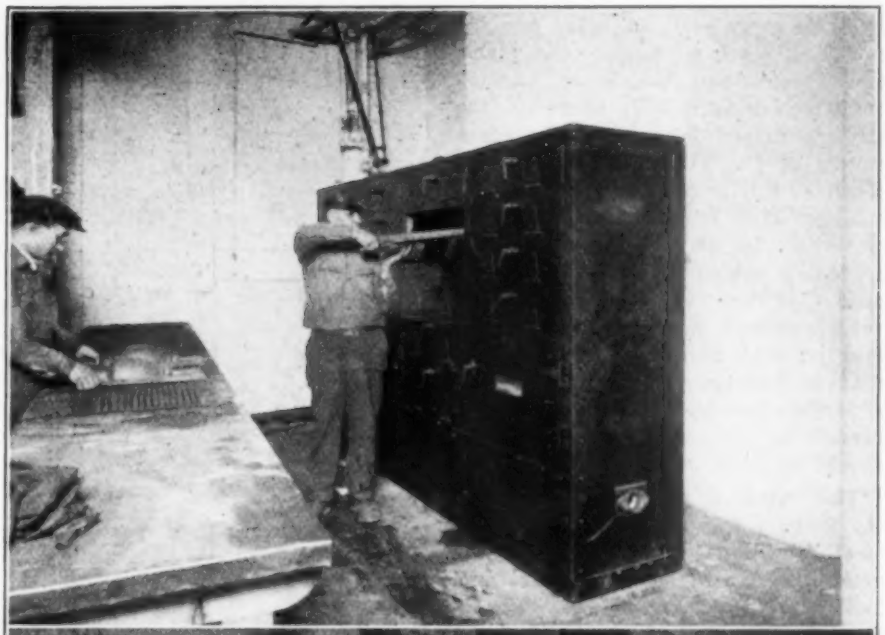


Fig. 6—Oil Fired Core Ovens Are Used. Fig. 7—A Hoist Is Used To Raise the Pots From the Furnace. Fig. 8—The Brass Furnaces In Operation

operations. The machine shown is a semiautomatic enameling device. Here the individual pieces set on small tables revolve about their own axis and at the same time they travel across the range of a multiple jet enamel spray. Much other equipment in the plant is of automatic or semiautomatic character. The pieces shown in Fig. 12 are baked in a continuous oven through which a belt conveyor passes, several coats of enamel frequently being required. Other operations are buffing, lacquering, and hand decorating. Each operation being carried out in its own department.

Following this policy a small brass foundry was operated to take care of the brass and bronze castings required for fixture parts and for patterns. Most of the brass fixture parts are of light weight and their production was taken care of in a small, inefficiently operated foundry.

A little over two years ago the company departmentalized its cost accounting system and clearly showed the fact that its small brass foundry was operating at a loss when castings produced were figured at the current market prices. The manager faced two alternatives. He either

could do away with the brass foundry and buy castings outside the plant, or he could put the brass foundry on a paying basis. He preferred the latter plan and following this made a survey of the whole situation. As a result of this survey it was decided to enlarge the foundry building and modernize its entire equipment. The reasoning behind this decision chiefly was that an experienced, well-paid superintendent was necessary to obtain efficient foundry operation, and that to warrant hiring such a man a larger foundry than that actually needed by the company requirements should be built.

The wing of the plant housing the foundry was a brick building with steel truss roof, and being of the general design of 30 or 40 years ago, had relatively few windows. Fig. 3 shows a corner of this old brass foundry and Fig. 4 shows a view of the one side of the foundry as it is today. The change was made as economically as possible and in extending the old building longitudinally the same general style of architecture was followed except that the relative window space was doubled. The old foundry floor level was high with respect to the ground level so that space was provided below the new foundry floor for a modern core room. Fig. 5 is a view in the new core room and Fig. 6 shows the first battery of oil fired core ovens designed for future extension. At present the foundry is equipped with 16 oil furnaces, each furnace having a capacity of approximately 200 pounds to a heat and under full capacity and continuous operation eight heats a day are taken. This means 1600 pounds of metal is melted per furnace per day or about 13 tons for the entire battery.

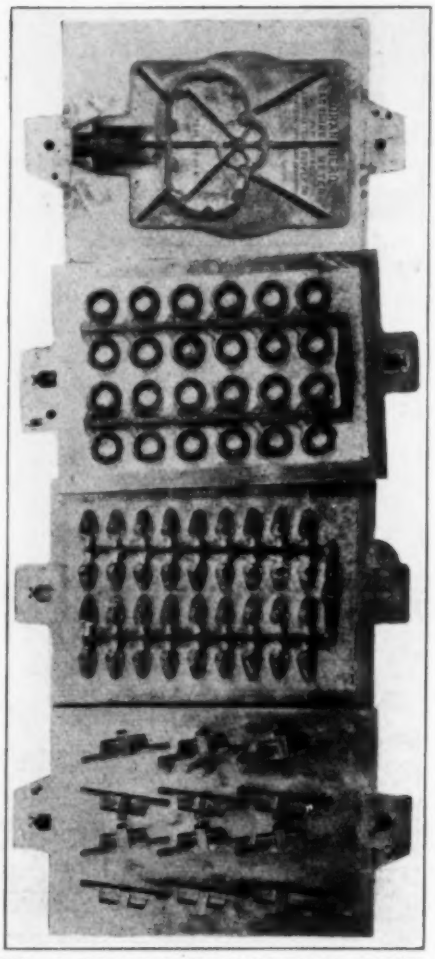


FIG. 9—MOLDS ARE MADE FROM ALUMINUM PLATES ON MACHINES

The pots are picked up by overhead trolley which runs along the center line of each battery. The hood carrying away furnace fumes is made in two sections one section being on each side of the trolley, thus providing for the travel of the rod supporting the hoist. A 1½-foot blower serves to exhaust the fumes from each battery of four furnaces. Overhead trolleys extend along each side of the foundry just in front of the pouring floors. Pouring is direct from trolley ladle for large castings, while for small work, double tier pouring is done from double shank ladles. Fig. 8 shows a close view of a section of the furnace battery.

Making The Foundry Pay

Having enlarged the foundry to a capacity of 13 tons a day to make it show a profit, the problem still was unsolved. In fact, when the plant first was completed, the management was inclined to feel that this might be an added burden rather than an economic measure. It was recalled with some encouragement that other manufacturers had enlarged foundries and had successfully entered jobbing business to produce their own castings at a saving. Notable among these was the case of the Gilbert & Barker Co., Springfield, Mass. This company about a year previous to the building of the Miller foundry extension built a complete modern steel foundry with a capacity many times that required for its own manufacturing, and successfully entered the jobbing trade to dispose of the surplus production.

At the Miller plant, the first step

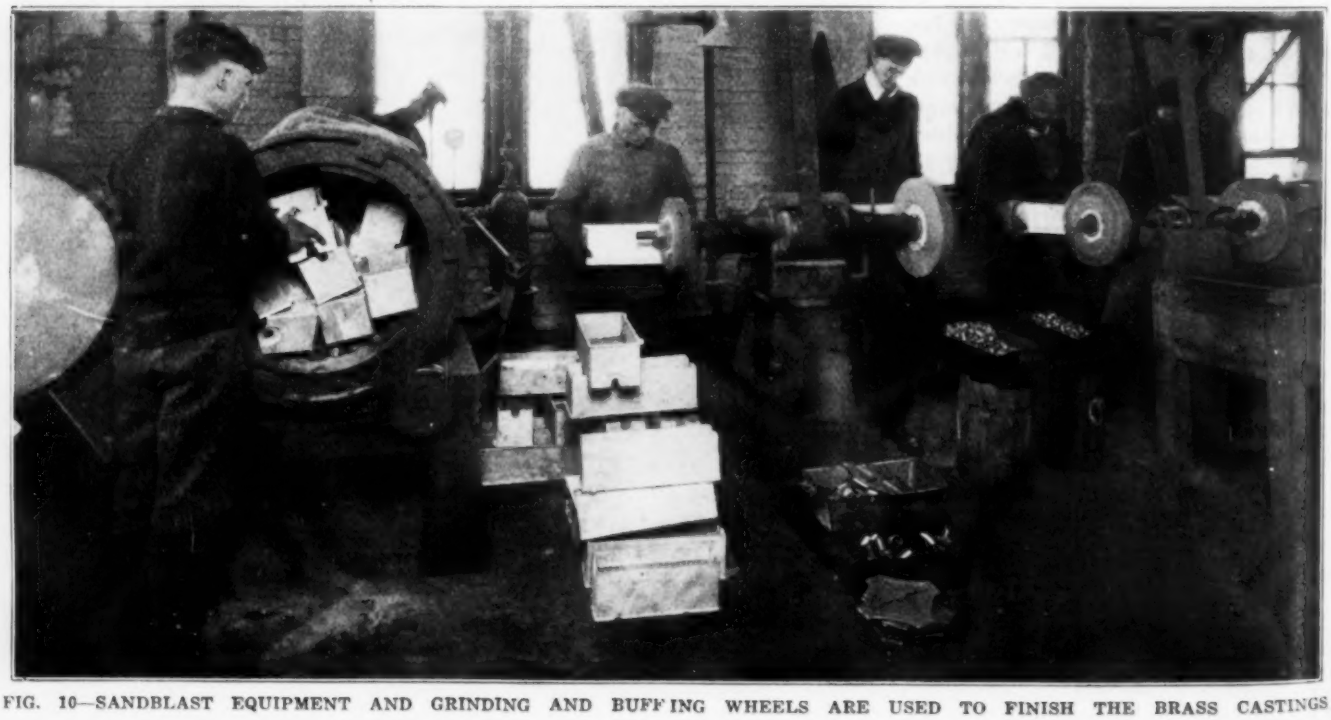


FIG. 10—SANDBLAST EQUIPMENT AND GRINDING AND BUFFING WHEELS ARE USED TO FINISH THE BRASS CASTINGS

toward putting the new foundry into operation was the acquisition of Joe Schwarz, an experienced brass foundryman as superintendent. The next step was to put the entire foundry on a complete independent basis. Under this arrangement castings used by the company were charged at prevailing market rates, and in the case of complaint or defective castings the responsibility was fixed first. New castings were made without charge only where the responsibility clearly fell on the foundry.

It frequently happens in a foundry operated as an integral part of a manufacturing plant that all sorts of odd jobs are brought in to take the time of the men, which give little credit to the department in the eyes of the plant management. Under such circumstances a foundry becomes sort of a general utility and repair shop. Under a fairly close cost keeping system much work is likely to be done which never shows on the records. However, when a foundry superintendent is told that the department is to all intents and purposes his independent business he is likely to see that the proper charge is made for all work performed. Therefore, the first problem was to establish a correct relationship between the company and the foundry. This was done by requiring requisitions, bearing work order numbers, for every casting produced. The second problem, and from an administrative angle the big problem, was to secure sufficient outside business at right prices to keep the entire foundry business and make it possible for production methods to lower the per pound costs.

FIG. 11—THE DROP FIXTURE REQUIRES GLASS, BRONZE AND BRASS IN VARIOUS FORMS

Most of the brass foundry work for lighting fixtures is plate work of a nature shown in the lower part of Fig. 9. For this reason outside work of a type which could be economically produced with the use of plates was solicited. The second from the top plate of Fig. 9 shows one such type of casting.

Other features in the story of the success of this foundry are merely a repetition of the many detailed matters which spell the difference between poor and good management. The foundry is now on a paying basis and the judgment of the management in enlarging a non-paying department to make it pay has been vindicated. When asked for the chief factors responsible for the foundry success the manager said good, efficient workmanship made possible by modern equipment and conveniences, a knowledge of costs, and an ability to sell the new plant and its service to prospective customers in the territory.

One additional contributing feature perhaps should be mentioned here. The plant with its many departments and diversified facilities required in the development of lighting fixtures is well equipped to machine, polish, lacquer and otherwise finish castings for its foundry customers. Fig. 10 shows one corner of the cleaning and polishing room, which is used ordinarily on fixture castings, engaged in finishing up a run of cast brass boxes for an outside customer.

The Chicago district sales office of the Whiting Corp. has been moved from 945 Monadnock block to 1502 Railway exchange. R. S. Hammond is district manager.

FIG. 12—FIXTURE PARTS ARE ENAMELED RAPIDLY IN SEMIAUTOMATIC MACHINES

Hardness Governs Machinability

Difficulty in Machining Cast Iron Offers a Co-operative Problem for Machine Shop Superintendent and Foundryman

By James Ward

A FOUNDRYMAN often is tempted to disregard the machinability features of his castings. However, this question must be considered when the machine shop, or the customer in the case of a jobbing foundry, complains that the castings are not satisfactory. Something obviously is wrong when the machining time runs up, and while the metal may be at fault, more often the trouble is due to other causes. It is an easy matter to assume that the trouble is with inanimate material.

It is a bad policy for the foundryman to assume the blame without a thorough investigation. In some cases the foundryman may be induced to make weak, spongy castings, thereby lowering the value of his product, and also preventing the discovery and remedy of the real trouble. Difficult machinability is a problem requiring the co-operation of the foundry and the machine shop. Machining is a complex operation involving many imperfectly known factors, and no hard and fast rules may be established. This article will discuss some of the general phases of the machinability of cast iron, and the effect of some of the factors occuring in the machining operations will be pointed out with the cause and care.

Machinability of a metal commonly is thought to depend on its hardness. In cast iron there are two types of hardness which affect machinability, namely *strength* hardness as measured by the brinell test, and *abrasive* hardness. Transverse strength is related closely to brinell hardness, as shown in Fig. 1.

The stronger a metal, the greater resistance it offers to the tool. The ability of cutting tools to withstand the service imposed upon them limits the operation of modern machine tools. The theoretical maximum feed, depth of cut, and speed depend on the strength of the material. In actual

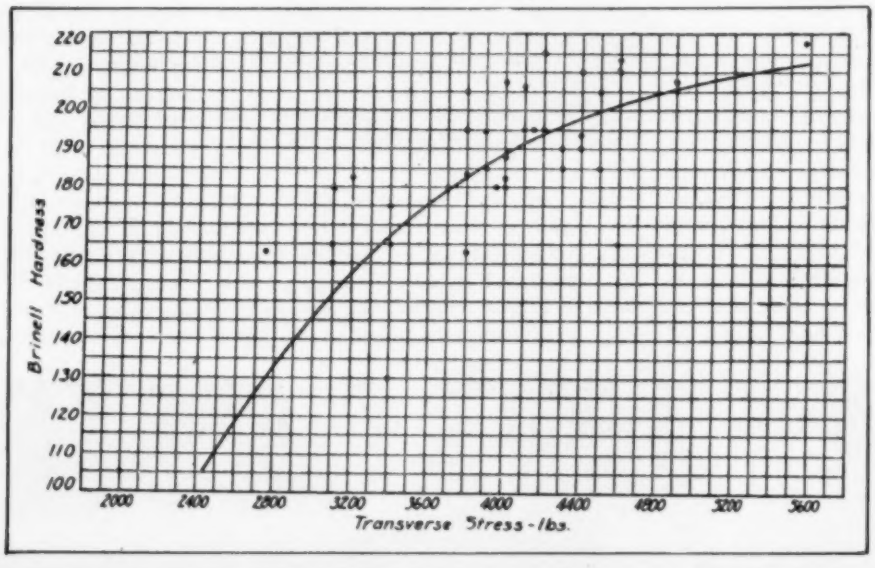


Fig. 1—(Right) Curve Showing Relation Between Brinell Hardness and Transverse Strength

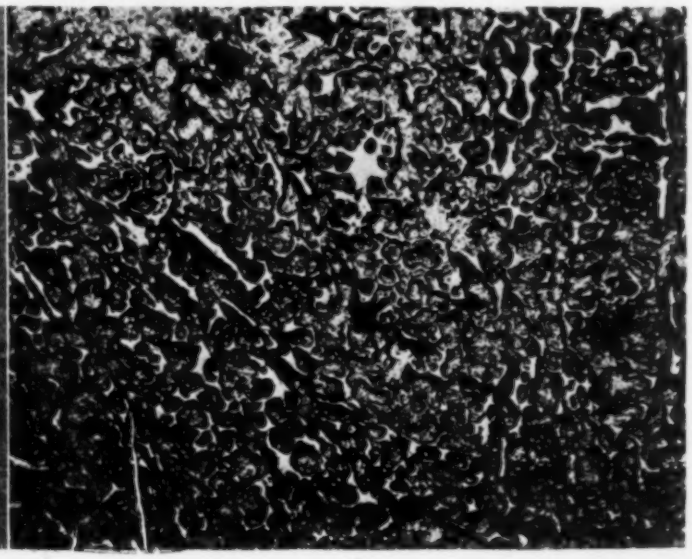
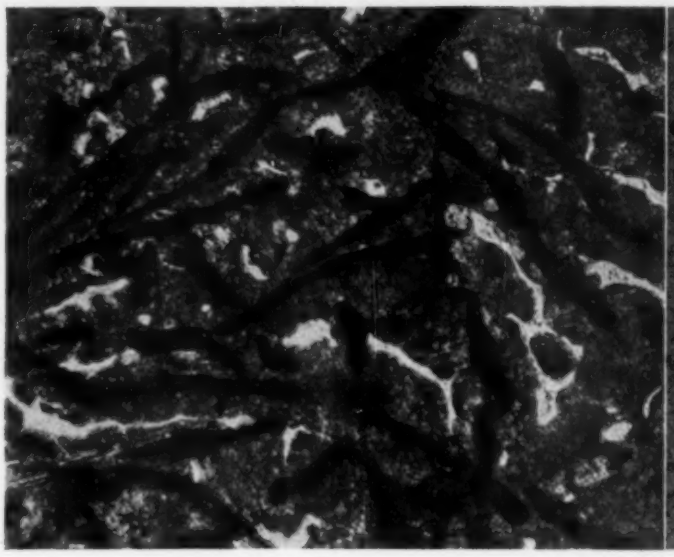


Fig. 2—(Left Below) Steadite shown by relief polishing. Magnified 600 Dia. Fig. 3. (Right. Below) Cementite Magnified 100 Dia.



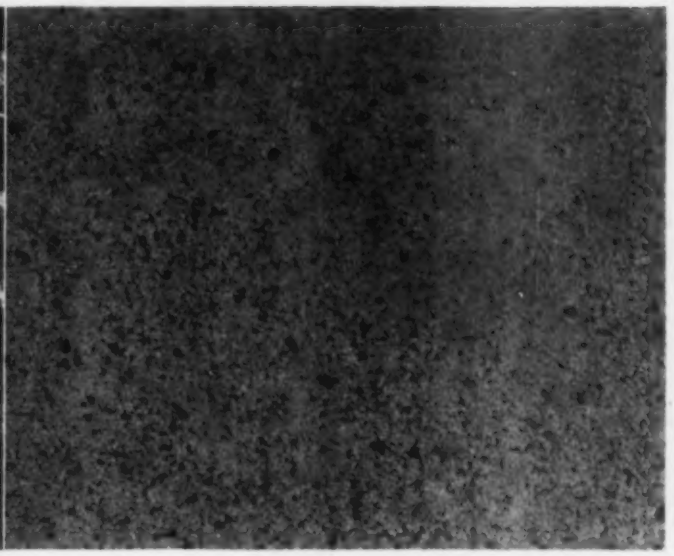


FIG. 4—DISTRIBUTION OF STEADITE IN GRAY IRON, MAGNIFIED 100 DIA. FIG. 5—SHOWING AN OPEN GRAIN CAST IRON. NATURAL SIZE

shop practice the difference in overall cutting time on strong and on weak gray iron castings is not as great as one might expect. In many cases no practical difference is noticeable. A soft weak iron may run about 10,000 to 14,000 pounds tensile strength and 100 to 120 brinell reading. While such an iron may prove easy to *hog*, it will tear out badly and requires more finishing cuts than a high test iron of 30,000 to 35,000 pounds tensile strength and 180 to 200 brinell reading. In the case of steels, it is found that low carbon steel will rough easier than heat treated alloy steel of 275 brinell reading, but soft steel is harder to finish properly. Gray iron castings of low brinell reading are undesirable because such material is weak, open grained, and too soft to wear well. The strength machinability of gray iron is limited by the service

FIG. 6—COARSE GRAPHITE STRUCTURE. MAGNIFIED 100 DIA.

which the iron must give when in use.

Metal usually breaks off or is pushed off in advance of the tool in cutting cast iron and semi-steel, whereas in cutting steel the action more nearly is that of shearing or of tearing off the chip. Failure of the tool in cutting cast iron often seems to be due to gritty material in the iron. Taylor, in his classic paper "The Art of Cutting Metals," states that it also is probable that cast iron, containing more carbon in the form of gritty graphite, which is combined in a hard state, is more abrasive in its action on the tool. All these conditions tend toward rapid wear of the tool close to the cutting edge, and therefore, to slow cutting speeds.

The abrasive effect is more evident in some irons than in others. For this reason two irons of the same strength may differ in their machinability. There are abrasive com-

FIG. 7—SAME TYPE STRUCTURE AS IN FIG. 6, AFTER GRINDING AND POLISHING. MAGNIFIED 100 DIA. FIG. 8—FRACTURE FOLLOWS GRAPHITE FLAKES IN PATH OF LEAST RESISTANCE, MAGNIFIED 100 DIA.

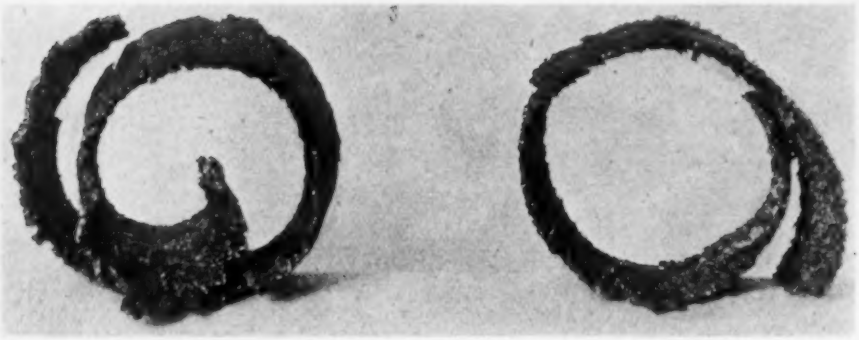


FIG. 9—PIECES OF CAST IRON CUT BY THE CHIPPING HAMMER

ponents in gray iron, although these abrasives are not graphite, as conceived by Mr. Taylor. Steadite, the iron-phosphorus component, and free cementite are the worst offenders. The metallographist demonstrates this by relief polishing as shown in Figs. 2 and 3. In relief polishing the metal specimen is polished a long time, using a soft backing and fine polishing powder. The process causes the softer portions of the metal to be worn away, the hard parts remaining in bas-relief, as shown in the micrographs. Free cementite occurs only in white or mottled irons. A chilled iron is difficult to machine. If the depth of cut extends under the chill the cutting is not so hard as when an attempt is made to force the tool through the cementite. Free cementite is the common cause of hard spots in small castings. The main sources of this trouble are too low silicon, carbons either too low or too high, and lack of proper control of manganese and sulphur. While up to a certain point carbon increases the graphitization, and hence the machinability, carbon above the eutectic promotes the formation of massive cementite which separates at a relatively high temperature. The author noted this feature in some piston rings of proper silicon content. The rings with hard spots had nearly 4.0 per cent carbon, the eutectic being around 3.7 per cent. Changes in practice which lowered the carbon to 3.7 per cent removed the trouble. Low carbon irons tend to chill readily.

Phosphorus is a decided *abrasive* hardener. Steadite is nearly as hard as feldspar. Steadite is found throughout the metal, as shown in Fig. 4, often occurring in network formations. Phosphorus is said to increase the strength and brinell hardness. Where over 0.50 per cent it decreases deflection and machinability. The effect on machinability is not so apparent in softer iron. In case of highest test irons the author has seen castings made unmachinable by an increase of 0.30 to 0.40 per cent in phosphorus, the remainder of the analysis being the same. In one shop the strength of the mixture was raised 50 per cent in the heavy castings with no increase in overall machine time. Previous experience of this shop had indicated that higher strength irons were difficult to machine. The success of the change is attributable to a lowering of 0.50 per cent in phosphorus content of the mixtures.

Sand is an abrasive whose effect must not be overlooked. Dirty, scabby castings with burned-in sand cause the machinist trouble. Abrasives are particularly detrimental to tool life.

Machinability is a relative term. There is no exact measure of machinability as different types of machining do not react the same to changes in hardness. An iron which planes well might prove difficult to scrape.

The finish depends on the type of machining and on the metal. Any cast iron may be given a good appearance. Only the poorest grades of iron ever have excessive open grain. These statements are not as paradoxical as they may seem. The machining operation may have one of three effects on the cut surface. A heavy roughing cut may tear out the grain structure as shown in Fig. 5. The best example of true cutting is the metallographic polishing operation. Filing and grinding peen over the grain as shown in Figs. 6, 7 and 10. For this reason gray iron castings cannot be judged by the appearance of the machined surface. An open grain iron implies a weak iron, and a close appearance does not mean a strong iron. These facts are strongly emphasized because lack of this knowledge has led to many erroneous impressions of castings quality.

Coarse finish is attributable to coarse graphite or to shrinkage, coarse graphite being one of the commonest causes of open grain. The reasons for this is that the line of fracture follows the graphite flakes as demonstrated in Fig. 8 and the pits, due the grain themselves, cause an open appearance.

Shrinkage often is overlooked as a cause of coarse finish. Wherever open grain is quite local, or where actual sponginess appears, it is common to find that the trouble is traceable to shrinkage, which may be severe, resulting in a jagged cavity, or it may be partial, resulting in sponginess. Where an actual cavity occurs, the metal surrounding it usually shows evidence of sponginess. The usual cause of shrinkage is that an unequal metal

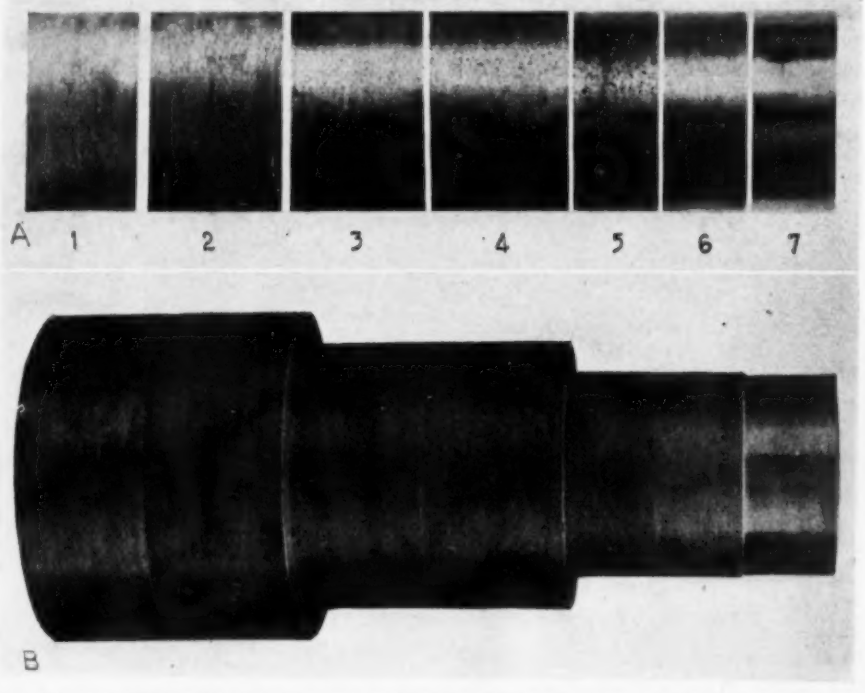


FIG. 10—SHOWING EFFECT OF VARIOUS FINISHES AND DEPTHS OF CUT

area occurs near the meeting point of a thin and heavy section, diagnosis of the trouble as shrinkage generally is correct.

Differences in grain in the same casting sometimes appear, due to variations in the cooling area. Heavy sections are coarser grained than the light ones on the same casting providing chills have not been used. Deeper finish of cut commonly causes a more open appearance. To domonstrate this a solid bar 8 inches in diameter and 18 inches high was cast from a soft iron and was turned to three different diameters, as shown in Fig. 10B. Then portions of each diameter were given different finishes, as follows:

(1) ⅛-inch stock (diameter) removed, 1 roughing cut, 3 finishing cuts and filed.

(2) ⅛-inch stock (diameter) removed, 1 roughing cut 1 finishing cut.

(3) 2-inch stock (diameter) removed, 1 rough and 3 finish.

(4) 2-inch stock (diameter) removed, 1 rough and 1 finish.

(5) 4-inch stock (diameter) removed, 2 rough and 1 finish.

(6) 4-inch stock (diameter) removed, 2 rough and 4 finish.

(7) 4⅛-inch stock (diameter) removed, roughed and ground.

This shows that greater depth of cut means coarser grain, and that the worst material can be given a good finish. Compare (5) and (7), both of which are coarse, weak portions. Fig. 10A as the same as Fig. 10B, but blocked off to give greater contrast to finishes.

Warpage gives rise to close and open grain on the same casting. Fig. 11 represents a warped rectangular section, to be cut to section shown as *XXXX-XXXX*. In long heavy sections the sand is not strong enough to furnish rigid support to the mass of metal. This results in sagging. When machining most excess stock is removed at parts *BBB* while at *AAA* only the thin outer skin of the casting is removed. For this reason parts *AAA* show close grained while at *BBB* coarse grain is found. Thus the mystery of close and open grain in the same piece of uniform section is explained. The illustration, as given is exaggerated. In practice various means of support and changes in design avoid such difficulties.

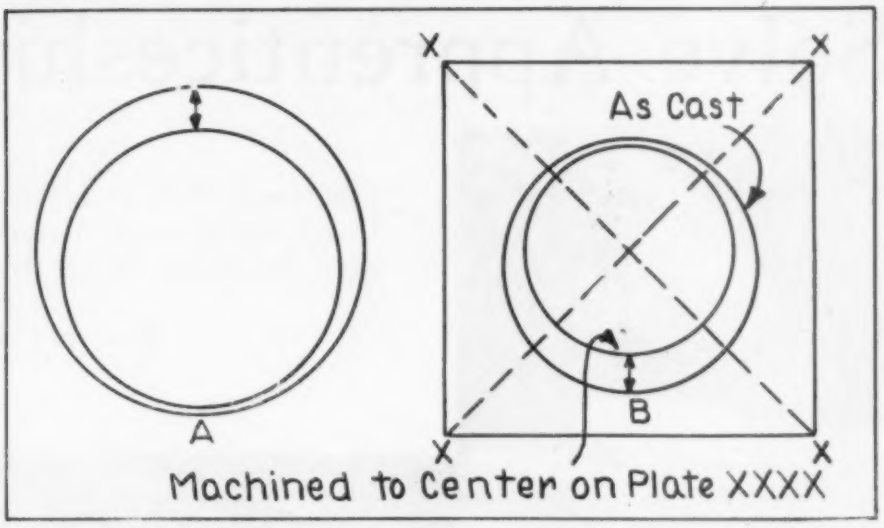


FIG. 12 *A*—CYLINDRICAL PIECE OF CAST IRON CUT OFF CENTER. *B*—IRON CORED OUT OF CENTER

Strength hardness and abrasive hardness, as previously considered are factors which may be controlled by the foundryman. Open grain and shrinkage are troubles within the scope of foundry metallurgy. The machining operations themselves are a fertile source of difficulties.

Fig. 12A shows a cylindrical piece of cast-iron cut off center, having a greater depth of cut off on one side, as shown at *B* in the illustration. On separate solid cylindrical shapes this trouble is due to the machinist. If the cylindrical section is joined to another section, cutting off center may be necessary to get the rest of the casting lined up, as shown in Fig. 12 *B*. If a cylindrical shape is cored out, an off center core necessitates turning the outside off center or boring the hole off center. Such foundry and shop errors may be the direct cause of open grain appearance.

The personal equation always is present and it is easiest to blame inanimate materials. If there is some difficulty and the iron has received the blame on other occasions, it simply is following the course of least resistance to place the blame there again. An illustration based on a consulting experience demonstrates this. A foundry had trouble with certain castings for a number of years. Difficulties in accuracy of machine shop work was another source of losses. Some time after the foundry trouble was minimized the machine shop difficulties also became less and greater confidence in the castings led the machinists to exert greater care.

Suppose that a foundry claims to make strong, hard castings, hard meaning wear resisting. To the shop man hard also implies a casting difficult to machine and as a result, every little difficulty with the casting is noticed and unconsciously magnified. Unless production figures are available, trouble may be in store for the foundryman. Machinists are high grade mechanics and where things are clearly explained to them, usually they will be found willing to co-operate.

In some cases the machine may be too light for the work. An underpowered machine cannot give good production and if the casting or tool are not properly clamped bad work and chattering may follow. Slow machining time may be due the cutting tool and trouble from the tool may be traceable to improper heat treatment or to the way it is ground.

The method of operating the machine may be at fault. Speed, feed and depth are variables in operation. Sometimes slower speed and greater feed and depth may produce best results in other cases the opposite combination may prove better. While the foundryman cannot make a detailed study of all these factors, recognition of their existence often proves of value.

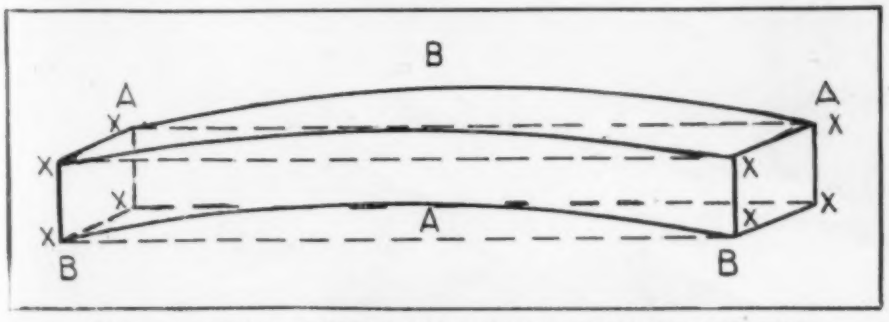


FIG. 11—SHOWING A WARPED RECTANGULAR SECTION OF CAST IRON

Solve Apprenticeship Problem

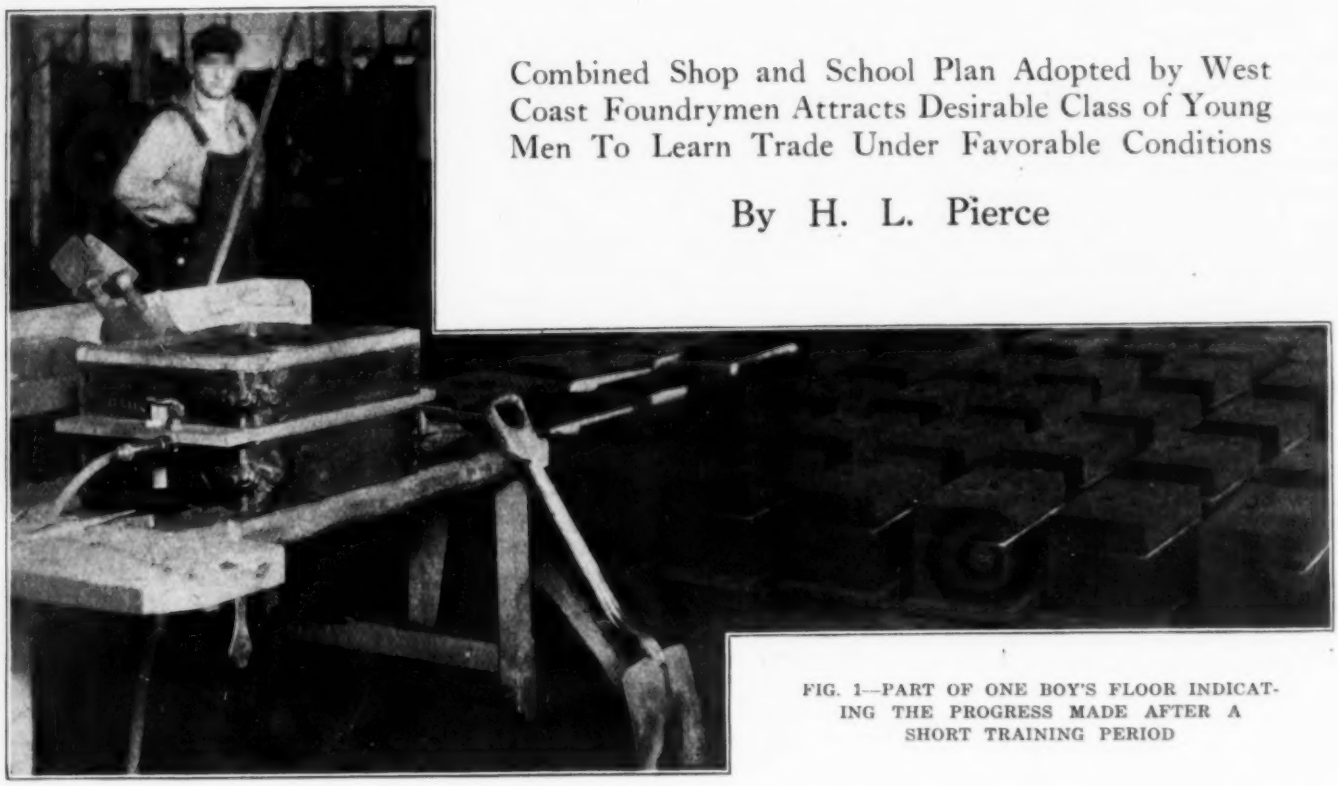


FIG. 1—PART OF ONE BOY'S FLOOR INDICATING THE PROGRESS MADE AFTER A SHORT TRAINING PERIOD

Combined Shop and School Plan Adopted by West Coast Foundrymen Attracts Desirable Class of Young Men To Learn Trade Under Favorable Conditions

By H. L. Pierce

THREE years ago when a group of foundrymen in the San Francisco bay district decided to install a thorough and comprehensive apprenticeship system they experienced considerable trouble in securing candidates even though a bonus was offered above the usual rate. A little later when the potentially interested section of the public became convinced that the employers really were sincere in their offer to teach boys the trade in a proper manner, also were prepared to pay on a gradually ascending scale according to the capability of the apprentice, more applications were filed for positions than possibly could be filled. During the past year over 100 boys have been selected from a list of over 300 who had at least a grammar school education and who were desirous of learning the trade and attending the night classes.

Foundry foremen have been educated to the point where they realize the desirability of training appren-

FIG. 2—APPRENTICE COREMAKERS IN TRAINING AT PLANT OF THE PACIFIC MALLEABLE CASTINGS CO., OAKLAND, CALIF.

tices. Meetings are held monthly to discuss points in connection with the training programs. Foundry owners are gratified at the successful culmination of the combined shop and school program which they inaugurated.

The manager of one prominent plant states that he watched closely the progress of his apprentices and found that the boys who attended the school forged ahead much more rapidly than the others. Now he insists that all his boys take the full course of instruction provided. He claims that unless a boy displays a desire to acquire all the knowledge available, he is not of the proper caliber to merit consideration. He never will be a credit to any trade or calling.

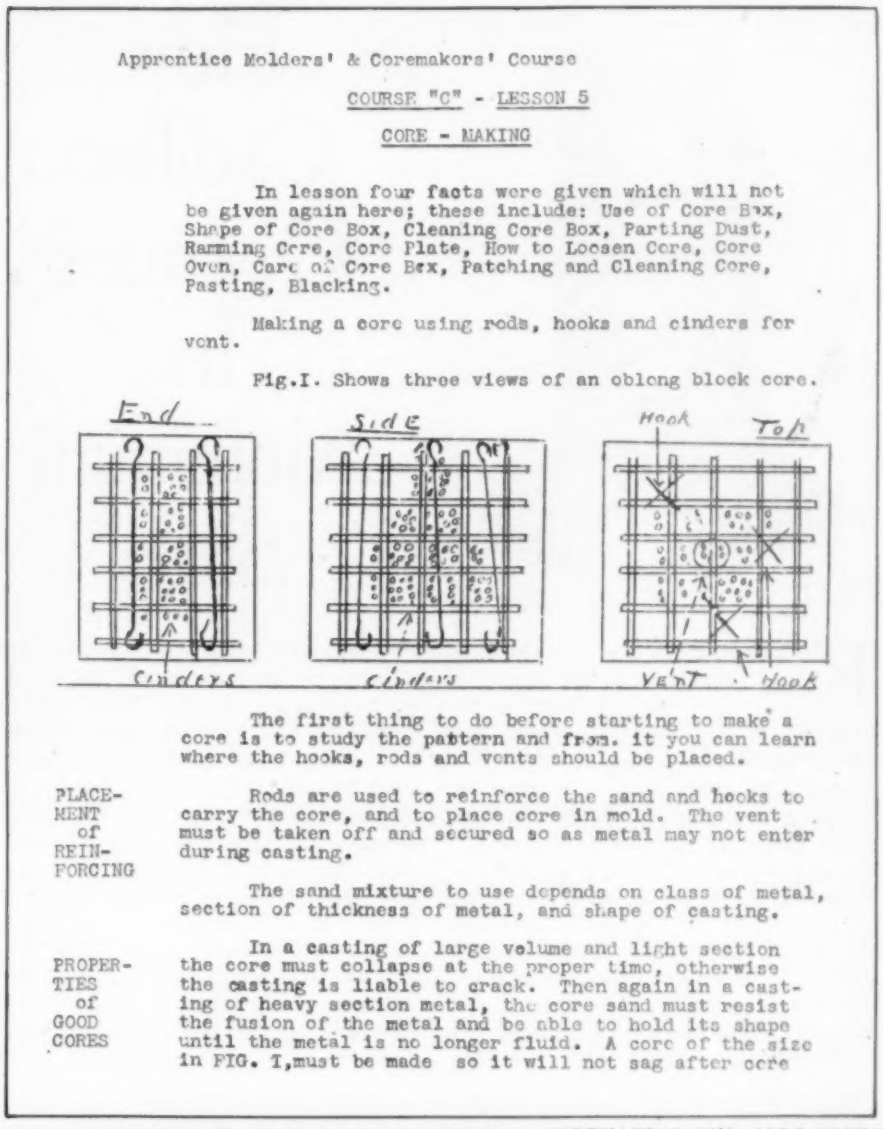
The school operated in connection with the training system holds sessions on four nights per week, two in San Francisco and two in Oakland. The courses of instruction have been compiled from the best available sources with a definite plan in view of making the courses applicable to the everyday shop problems of the students. Up to the present both foremen and apprentices have shown a lively interest.

Diversified Program

For convenience in presentation the subjects studied in night school have been divided into nine courses and labeled under consecutive heads from *A* to *I*. The first course *A* includes lessons in the general requirements of all around coremakers and molders: Shop equipment, squeezers, molders and coremakers' tools, etc.; sands, causes for defective castings, flasks and patterns.

Course *B* is designed to cover green sand molding features, ramming, gating, risers, venting, clamps and chaplets. Course *C* is devoted to coremaking; *D* to simple plan drawing and applied mathematics; cupola practice and elementary metallurgy are covered in course *E*. A special course in nonferrous foundry practice is listed under *F*. Other special short courses in malleable iron and steel foundry practice are presented under the heads *G* and *H* respectively. Production methods and molding machines are reserved to the end of the program under the heading *I*.

The apprentice is rated after completion of each course for which he is given credit on his training card. If he does not pass in a course, he is required to take it over again. Ratings are given apprentices mon ly by the individual shop apprentice supervisor showing extent of experience gained and rate of progress in quality and quantity. After each six months period the apprentice's rate of pay is increased 50 cents per day if the increase is warranted by his standing in the school and the shop. In exceptional cases advancement is made ahead of schedule.



Apprentice Molders' & Coremakers' Course

COURSE "C" - LESSON 5

CORE - MAKING

In lesson four facts were given which will not be given again here; these include: Use of Core Box, Shape of Core Box, Cleaning Core Box, Parting Dust, Ramming Core, Core Plate, How to Loosen Core, Core Oven, Care of Core Box, Patching and Cleaning Core, Pasting, Blacking.

Making a core using rods, hooks and cinders for vent.

Fig.I. Shows three views of an oblong block core.

The first thing to do before starting to make a core is to study the pattern and from. it you can learn where the hooks, rods and vents should be placed.

PLACEMENT of REINFORCING

Rods are used to reinforce the sand and hooks to carry the core, and to place core in mold. The vent must be taken off and secured so as metal may not enter during casting.

The sand mixture to use depends on class of metal, section of thickness of metal, and shape of casting.

PROPERTIES of GOOD CORES

In a casting of large volume and light section the core must collapse at the proper time, otherwise the casting is liable to crack. Then again in a casting of heavy section metal, the core sand must resist the fusion of the metal and be able to hold its shape until the metal is no longer fluid. A core of the size in FIG. I,must be made so it will not sag after core

FIG. 3—FACSIMILE OF FIRST PAGE OF *COURSE C*, COREMAKING AND CORE SANDS

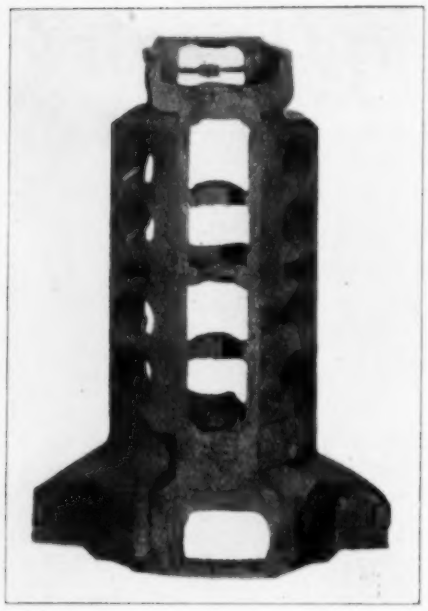
Issue New Catalog

Westinghouse Electric & Mfg. Co., East Pittsburgh is distributing its new 1925-27 catalog of electrical supplies. The publication contains 1200 pages, and is profusely illustrated. All new apparatus designed and manufactured in the past two years as well as the old established types are listed. The catalog has three indexes, making it easy to find any particular piece of apparatus by using the thumb, tab, subject or classified index. It is a valuable addition to the library of any buyer of electrical equipment.

Some interesting facts about the catalog are that more than a ton of ink was used, ten tons of type were set, and 4500 engravings were used in the printing of the publication.

Foundry Supplies Make Important Industry

According to data collected at the biennial census of manufactures, 1923, by the department of commerce, the plants engaged primarily in the manufacture of foundry supplies reported a total output valued at $10,247,864, of which amount $6,196,293 represents foundry facings, core compounds and core oil; $769,421, chaplets; $516,013, molding sand; $338,512, foundry equipment such as flasks, sieves, brushes, ladles, etc; $193,614, flux; and $2,234-001, other products, reported as foundry supplies. The output for 1923 shows an increase of 106.4 per cent as compared with 1921, the preceding census year.



How Cadillac Operates Its Aluminum Shop

REFERENCE to many of the general features of the group of foundries recently placed in operation by the Cadillac Motor Car Company, Detroit, was made in The Foundry of Aug. 1.

Space limitations prevented the presentation of a description of the many interesting items of detail that enter into the successful functioning of the plant. The foundry, comprising four separate departments is operated as a unit so far as the entire Cadillac plant is concerned, but each of the four departments, the aluminum foundry, the brass foundry, the coreroom and the iron foundry, enjoys complete autonomy in its departmental operation. Each of the foundries has its own sand distribution system, its own melting equipment and its own cleaning room. The coreroom is located in the brass foundry building which lies between the aluminum foundry on the one side and the iron foundry on the other. It is separated from the brass foundry by a brick partition. With this arrangement the making, drying and assembling of cores is concentrated in one place with the usual advantages that accrue to the concentration of effort of any kind at any given point.

Taking the various departments in the order indicated in the preceding paragraph and entering the plant from the south, the aluminum foundry is first to receive attention. It is housed in a building 122 x 381 feet, floored with brick and laid off in three main longitudinal divisions. Miscellaneous small castings are molded and poured on one side, the melting furnaces and metal store rooms occupy the center division and the large castings, crankcases and transmission housings are molded and

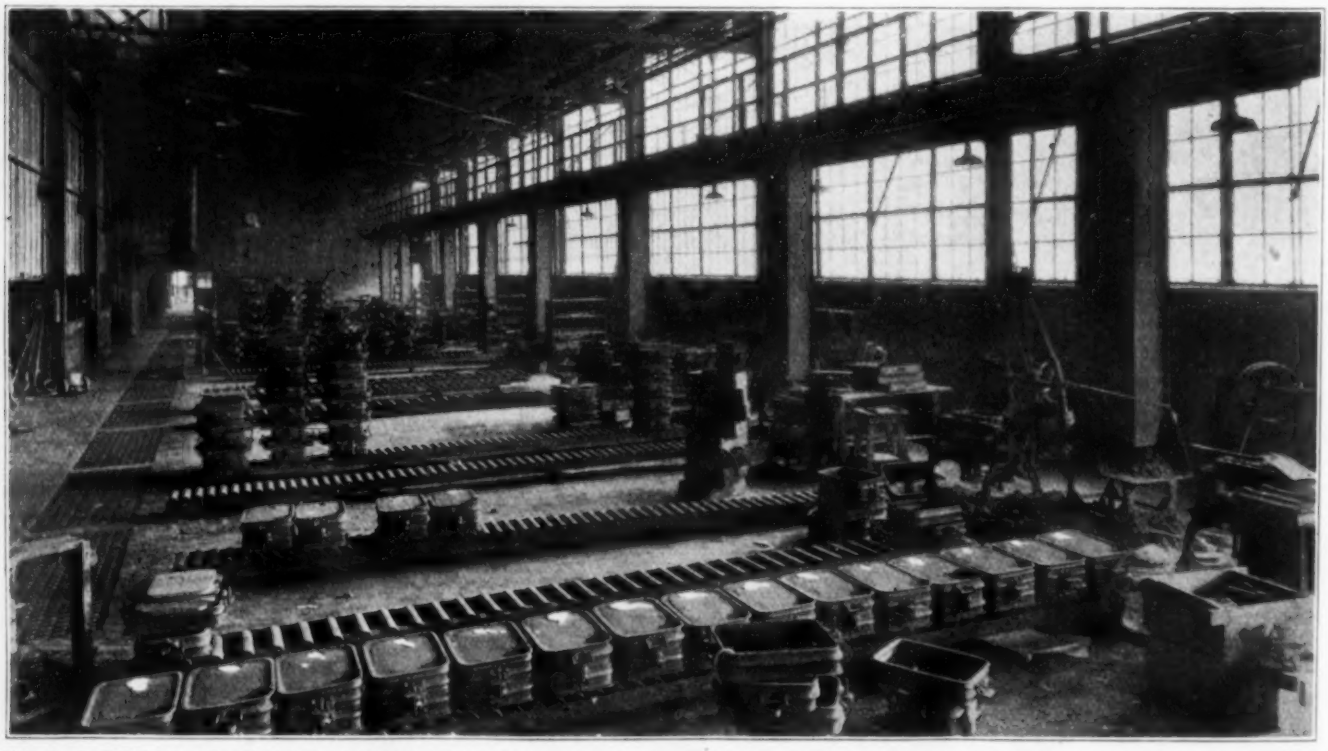


FIG. 1—A STREAM OF SMALL MOLDS TRAVELS CONSTANTLY BETWEEN THE MOLDING MACHINES AND THE GANGWAY WHERE THEY ARE POURED AND DUMPED. EMPTY FLASKS ARE RETURNED ON A CENTRAL CONVEYOR BETWEEN EACH PAIR OF MACHINES

STANDARD FOUNDRY GRINDING WHEELS

(Continued From Data Sheet No. 586)

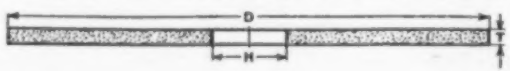
MINIMUM SIZES OF MACHINE SPINDLES

No user of wheels should operate on any machine of given spindle diameter a wheel of larger diameter or greater thickness than specified in the following table.

Diameter in Inches	Thickness of Wheel in Inches																		
	¼	⅜	½	⅝	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	4	4½	5
6	½	½	½	½	½	½	⅝	⅝	¾	¾	¾	¾	¾	¾	¾	¾	1	1	1
7	½	½	½	½	⅝	⅝	⅝	¾	¾	¾	¾	¾	¾	1	1	1	1	1	1
8	⅝	⅝	⅝	⅝	⅝	⅝	¾	¾	¾	1	1	1	1	1	1	1	1¼	1¼	1¼
9	⅝	⅝	⅝	⅝	¾	¾	¾	¾	1	1	1	1	1	1¼	1¼	1¼	1¼	1¼	1¼
10	¾	¾	¾	¾	¾	¾	¾	¾	1	1	1	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½
12	¾	¾	¾	¾	¾	1	1	1	1	1	1	1¼	1¼	1¼	1¼	1¼	1	1½	1½
14	⅞	⅞	⅞	⅞	1	1	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	1½	1½	1½
16					1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	1½	1½	1¾	1¾	1¾	1¾
18					1¼	1¼	1¼	1½	1½	1½	1½	1½	1½	1½	1¾	1¾	1¾	1⅞	1⅞
20						1½	1½	1½	1½	1½	1½	1½	1¾	1¾	1¾	1⅞	1⅞	1⅞	1⅞
24						1½	1½	1½	1¾	1¾	1¾	1¾	1¾	1¾	2	2	2	2	2
26							1½	1½	1¾	1¾	1¾	1¾	2	2	2	2	2¼	2¼	2¼
30								1¾	1¾	2	2	2	2	2	2¼	2¼	2½	2½	2½
36										2	2¼	2¼	2¼	2½	2½	2½	2¾	2¾	3

STANDARD CUTTING-OFF WHEELS

Type No. 1



Straight

D	T	H
6	⅛	As ordered
6	⅛	
7	⅛	
7	⅛	
8	⅛	
8	⅛	
12	⅛	
12	⅛	

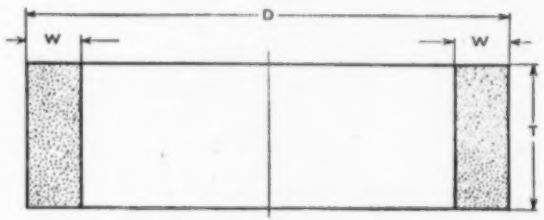
(Concluded on Data Sheet No. 588)

STANDARD FOUNDRY GRINDING WHEELS

(Concluded From Data Sheet No. 587)

STANDARD CYLINDER WHEELS

Type No. 2

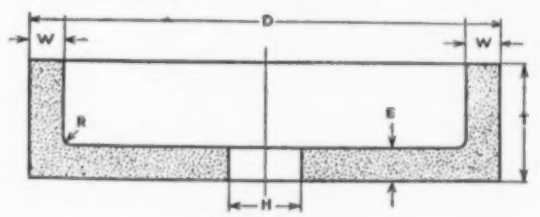


Cylinder

D	T	W
8	4	1
10	4	1
12	4	1½
14	4	1½
16	4	2
18	6	2
20	6	2½
24	6	2½
30	6	3

STANDARD STRAIGHT CUP WHEELS FOR GENERAL USE

Type No. 6



Straight Cup

D	T	H	W	E
8	4	As ordered	1	1
10	4		1¼	1¼
12	4		1½	1½
14	4		1½	1½
16	5		2	2
20	6		2	2
24	6		2½	2½
30	8		2½	2½

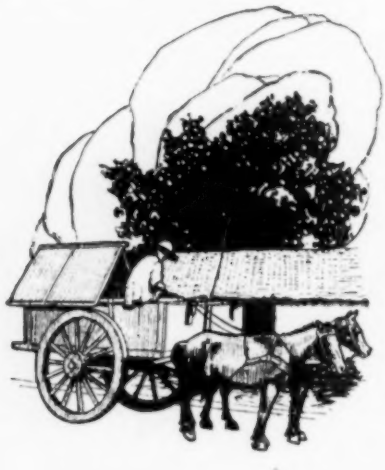
THE FOUNDRY DATA SHEET, SEPT. 1, 1925
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

Around the World with The Foundry

Little Journeys to the homes of our readers

Dutch East Indies!



OWNED and first exploited in 1610 by Europeans, Java, the queen of the Eastern Archipelago is the only part of the extensive colonies at one time controlled by the famous Dutch East India Company now acknowledged allegiance to the crown of Holland. The remarkable fertility of the soil and ideal living conditions are evidenced by the fact that with a total length of 600 miles from east to west and a width varying from 45 to 120 miles it maintained a population of over 29 million people. Java's fertility and productive qualities are only bounded by the scarcity of labor and in consequence of this fact much of the best land remains untilled.

The name is synonymous with coffee and in addition vast quantities of tea, rice, tobacco, indigo and sugar are produced and exported all over the world. Extensive manufacturing, repair, wood and metal working shops are maintained at Batavia, the capital, at Samarang and at Soerabaya, cities of approximately 2,000,000 each. These manufacturing establishments are capable of supplying the needs of 700 miles of railroads and the extensive shipping interests that center around the island.

Out of the total population only 60,000 are Europeans, mostly Dutch, and yet in spite of the combined disadvantages of race, distance and language it is significant to note that in at least three of the leading casting plants in the country The FOUNDRY is received twice a month and does its share to keep the executives in touch with the wide development in the casting industry.

"Wherever metals are cast you'll find THE FOUNDRY"

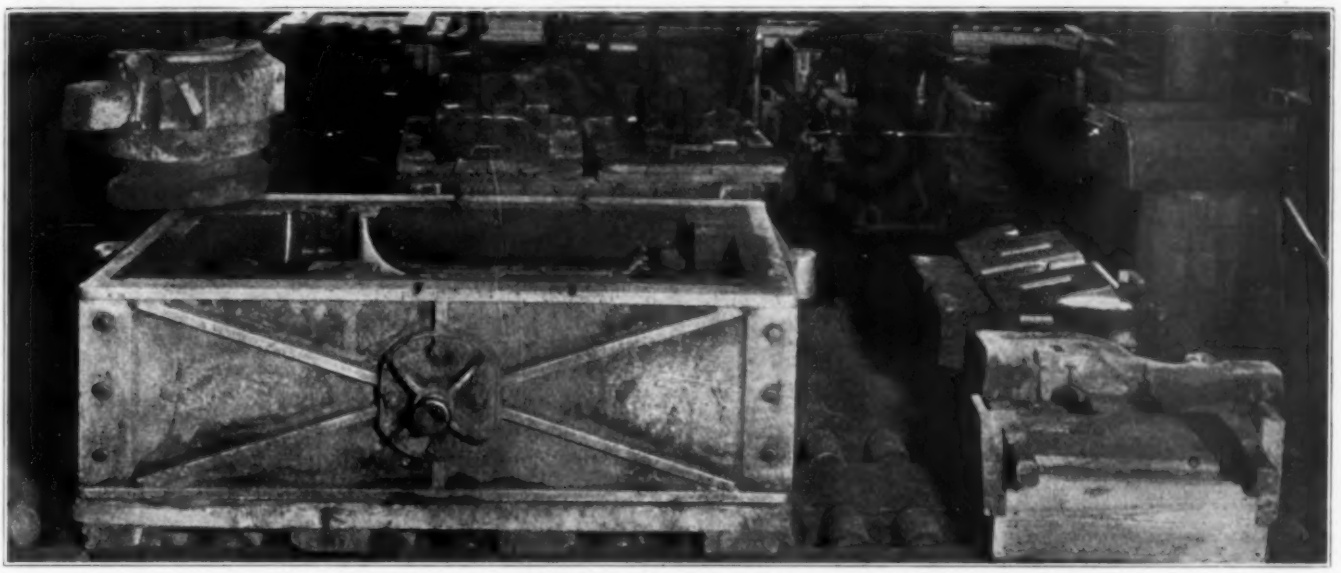


FIG. 2—ALUMINUM FLASKS ARE EMPLOYED FOR MAKING CRANKCASE MOLDS. THE MOLDS ARE ASSEMBLED AND POURED ON CONVEYORS IN WHICH THE ROLLERS ARE DIVIDED INTO TWO PARTS INSTEAD OF THE USUAL LONG SECTION

poured on the third section of the floor.

Pouring goes on continuously and, therefore, the floors are comparatively short on that side of the building where the small molds are made on a battery of air operated squeezing machines made by Berkshire Mfg. Co., Cleveland, International Molding Machine Co., Chicago, Henry E. Pridmore, Chicago, and the Arcade Mfg. Co., Freeport, Ill. A roller conveyor about 12 inches above the floor supplied by the Mathews Conveyor Co., Ellwood City, Pa., extends from each machine to the gangway which separates the molding floors from that occupied by the melting furnaces. A return conveyor is erected between each pair of machines. Each completed mold is lifted from the machine and placed on the conveyor in the immediate vicinity of the machine thus eliminating the necessity of the molder losing any time. Each mold pushes the one ahead of it a little further to the front. A pouring gang, constantly traveling up and down the gangway, pours the first few molds on each conveyor. These instantly are shaken out over gratings in the floor and the empty flasks placed on the return center conveyor.

With the foregoing arrangement it is apparent that a comparatively small number of flasks, a small floor space and a small quantity of sand suffice for the production of a large output of castings. Each flask is used from 10 to 15 times each day. In the case of snap flasks of course this feature only applies to the bottom boards and bands. By pouring the molds as fast as they are made, congestion is prevented and the furnaces may be operated in an orderly and uniform manner.

Sand requires little reconditioning treatment. The castings are light in section and therefore do not burn the sand. They are shaken out almost immediately after they are poured and as a result the great bulk of sand forming the mold does not even get heated.

A belt under the floor gratings carries the sand to a simple sand mix-

FIG. 3—GREEN SAND CORES FOR THE CRANKCASES ARE MADE IN A BATTERY OF 12 COREBOXES SET UP UNDER SAND HOPPERS REPLENISHED CONSTANTLY FROM AN OVERHEAD BELT

ing apparatus terminating in a large storage bin near the roof at one end of the building. A tramrail system installed by the Cleveland Crane & Engineering Co., Wickliffe, O., is utilized to carry the prepared sand from the storage bin and distribute it to the various molding stations on the south side of the aluminum foundry. Extension of the system is in use in other departments in the foundry group and will be referred to later.

The sand carrying unit suspended from the monorail is made up of three parts, a bucket fore and aft and a cab in the center for the operator who travels with the load. Each bucket has a capacity of 1800 pounds of sand and is provided with a gate in the bottom controlled by a hand wheel within reach of the operator. The monorail is suspended 19 feet above the floor and 6 feet above a platform erected directly above the row of molding machines. A tapered hopper with two spouts extends from the platform to a point a short distance above the center of each pair of machines. The hopper has a holding capacity of 2000 pounds of sand. It is open at the top where it is flush with the platform and is provided with a gate at the bottom of each spout by which the operator on the floor controls the flow of sand into his flask. It is the duty of the man in the cab above to keep the machine hoppers filled with sand at all times.

FIG. 4—METAL IS MELTED IN 21 OIL FIRED FURNACES ARRANGED IN THREE BATTERIES OF SEVEN EACH. THE GREATER PART OF THE CHARGE IS MADE UP OF SCRAP OLD AND NEW

In a test conducted to determine the efficacy of the tramrail system it was found that a man with a wheelbarrow could distribute 15½ tons of sand to the hoppers in a day. The operator on the monorail system handles 480 tons of sand in the same period of time. This is equivalent to the work of 29 men whose wages would amount to the cost of the installation in a short time.

A large quantity of metal is kept in stock in wire enclosures at both ends of the center section of the aluminum foundry. Approximately 50,000 pounds are melted daily in a battery of 21 furnaces arranged in two long rows with a dividing wall between. Seven furnaces together with an additional furnace employed exclusively in melting a *hardener* are on the side facing the light molding floors. The second row on the opposite side of the dividing wall and made up of 14 furnaces supplies the metal required in the third section of the foundry where the crankcases and transmission housings are made.

Fuel oil pumped from three tanks with a combined holding capacity of 60,000 gallons is employed to melt the aluminum. These tanks are located underground outside the building on the south side and in close proximity to the railroad where the supply of oil may be replenished readily from tank cars. The pumps and auxiliary equipment are installed in a concrete lined chamber also outside the foundry building and not far from the tanks. Pipes leading to the furnaces are suspended in a tunnel which with its various ramifications extends under all parts of the foundry. In passing it may not be out of place to state that the fuel pipes leading from the same pump chamber to the core ovens, also are carried in the same tunnel.

General appearance of the melting department is shown in Fig. 4. It is partitioned from the molding departments on either side by a corrugated sheet steel wall that stops short about 5 feet from the floor and a like distance from the roof. Its purpose primarily is to confine the smoke and fumes from the furnaces and to direct them toward the openings in the roof provided for the purpose. Natural currents of air entering under the partition walls are sent in an upward direction by the heat of the furnaces. Additional ventilation is provided through a series of gratings in the floor a little to one side of each furnace in front and above a tunnel with a fresh air intake.

Air for the burners is supplied by fans located in the tunnels, one fan for each battery of seven furnaces. Suitable gates are provided for regulating the volume of blast in the main pipe line and an individual gate is inserted in each pipe a short distance above the burner. With these checks and the usual valve on the oil line the intensity of the flame readily is controlled. Each pot has a capacity of 380 pounds. The castings on the light floors on the south side of the foundry are poured from hand ladles similar to those employed in iron foundries, but approximately one-third larger to compensate for the difference in weight between the two metals. A miniature cradle mounted on wheels takes the weight of the ladle while the operator is traveling back and forth between the molds and the furnaces.

Poured From Crucibles

Graphite crucibles are employed on the north side of the foundry to pour the crankcases and transmission housings. They are heated with an oil torch before they are placed in service each morning and thereafter are kept hot through constant use during the day. Approximately 180 pounds of metal is required to pour a crankcase casting. Two crucibles are employed to pour the metal simultaneously through horn gates at each side. It is stated that the average life of a crucible in constant service is about two months.

Molds for crankcases and transmission housings are made on several machines supplied by the Osborn Mfg. Co., Cleveland. The green sand cores are made on rollover machines from the International Molding Machine Co., Chicago. The lower half of the transmission core is made in dry sand and superimposed on the corebox containing the green sand half. The two halves then are rolled over as a unit, the corebox is removed and the completed core is lowered into the mold. It is anchored in place by the arbor which projects through the ends of the dry sand half of the core.

Crankcases are made and poured on a rectangular space bounded on two

sides by roller conveyors and on both ends by shaking out equipment. In the cycle of operation the flasks alternate from one side to the other. The molding machines are located near each end of the installation and receive the flasks immediately after they are shaken out. The conveyors travel in opposite directions and in effect turn the entire installation into a continuous process. For example a mold made at the west end is placed on the conveyor on the south side. It is cored, closed and poured while in transit and finally arrives at the east end where it is shaken out over a grating. The casting is taken to the cleaning room adjoining the east end of the foundry and the two half flasks either are stacked temporarily or are placed directly on the two molding machines located at this end. When the mold is rammed it is placed this time on the northern conveyor traveling west. It is poured en route and finally arrives at the western end where it is shaken out and once more started on the cycle.

Sand for Cores

With the exception of a few small cores made entirely from new sand, nearly all the dry sand core mixtures carry a certain amount of old sand. The percentage varies to a considerable extent depending on the relative position of the core in the casting and also its bulk. Thus in the dry-sand half of the transmission housing core, old sand is used in the mixture to the extent of 50 per cent.

On account of the intricate shape of the crankcase which may be noted in the two views shown on the first page, the core is made in green sand, reinforced at strategic points with dry sand sections and with chills. The total number of individual core parts set in each mold is 48. The green sand yields more readily than dry sand to the contraction of the metal in the casting and in that manner prevents the casting from cracking during solidification or afterward.

Sand at each of the shakeout stations falls through a grating upon a transverse belt which deposits it on a second belt running toward one end of the shop where it enters a mixing and revivifying apparatus and finally emerges from the bottom of a storage tank on to a belt which carries it back to the various molding stations. These various molding stations including those at which the green sand cores are made, are served by a set of hoppers similar to those on the south side of the foundry where the light castings are made. The upper end of the hopper is open for the reception of the sand. The lower end is provided with a hand controlled gate to regulate the amount of sand entering a flask or corebox. The sand handling equipment on this side of the foundry was designed and erected by the Palmer-Bee Co., Detroit in collaboration with the Austin Co., Clevleand, which designed and supervised the erection of the entire foundry plant.

Cleaning the Castings

Castings first are taken into a chamber 20 feet wide, 122 feet long extending the full width of the building between the foundry and cleaning room. Here the cores are knocked out and all the wires, nails and chills are reclaimed. The burned sand falls through a grating in the floor on to a belt which discharges into a storage hopper from which it is removed at periodic intervals. The good sand is shoveled into a revolving screen where it is pulverized and afterward returned to the core room.

Crankcases are suspended by hooks from a monorail and passed through a sandblast chamber made by the W. W. Sly Mfg. Co., Cleveland. Other cleaning equipment in the same department include band saws, grinding wheels and pneumatic chipping tools. Castings on which minor repairs have to be effected are preheated in four oil fired furnaces located close to one end of the cleaning room. They are raised to a temperature of 375 degrees Fahr., and then repaired with an oxyacetylene welding device. Features connected with the brass foundry, the core room and the iron foundry will be taken up in early future issues of THE FOUNDRY.

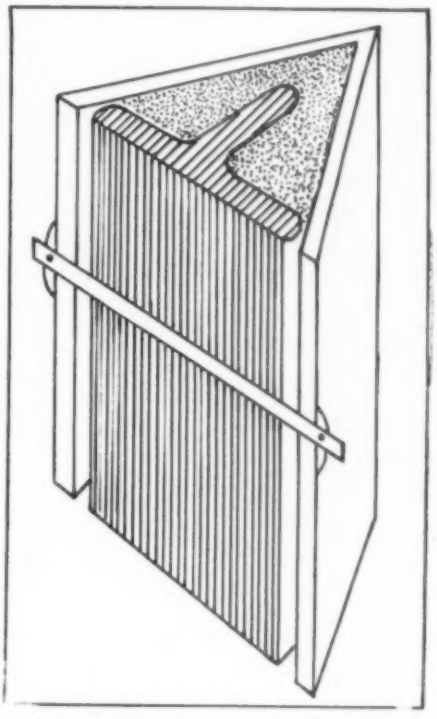
Advocates Practice of Closing Tap Hole

By C. E. McCampbell

Reference to the use of the oxy-acetylene torch in thawing the frozen tap hole in a cupola appeared some time ago in THE FOUNDRY. As an emergency measure the practice is commendable, but with proper care a frozen tap hole only comes within the realm of remote possibilities. If the cupola is lighted with a torch, the breast is rammed in place after the coke has been well ignited. The sand is scooped away on a slant on the outside so that the tapping hole will be no more than 2 inches in length. A few minutes application with the torch will suffice to dry the spout in the vicinity of the breast.

Light scrap sometimes commences to dribble down before the blast is put on and the first few pounds of iron melted after the blast is put on usually is *dead*. In both cases the iron shows a tendency to freeze in the tap hole. The best way to prevent this is to plug the tap hole before the wind goes on. A short piece of core or even molding sand from the floor may be employed for the purpose. After the first tap, the hole is stopped in the regular manner. The method of leaving the tap hole open until the first iron appears represents sloppy practice and is entirely unnecessary.

The device shown in the accompanying illustration was developed to prevent a rather remote cause of accident.



THE CAST-IRON BOOT IS PACKED FULL OF HEAP SAND

Recently we had to replace the legs under a cupola on account of the manner in which they were cracked and bent from exposure to fire and water. To prevent this from occurring a second time a V-shaped casting was placed in front of each leg and packed full of sand.

Steel to the extent of 3,470,000 tons was required in 1923 for the building of motor vehicles, an increase of almost 1,000,000 tons over the 1922 consumption and of over 2,000,000 tons over the 1921 consumption.

Aluminum consumption in 1923 increased 25.8 per cent over 1922 and 111.5 per cent over 1921. The total amount used being 91,514,000 pounds, as compared with 72,706,900 in 1902 and 43,250,000 in 1921.

Computing Ferroalloy Additions

By J. Battyson George

PROF. CAMPBELL'S ingenious and interesting *alloy mixture calculator* illustrated in your issue of May 15, 1925 fails to appeal fully to the careful steelmaker in that an error is involved. It is admitted that when only small increments of a special element are to be added, the error through failing to observe the *law of availability* may be small, but the point is not merely of academic interest and steelmakers should be instructed to observe every detail that insures accuracy.

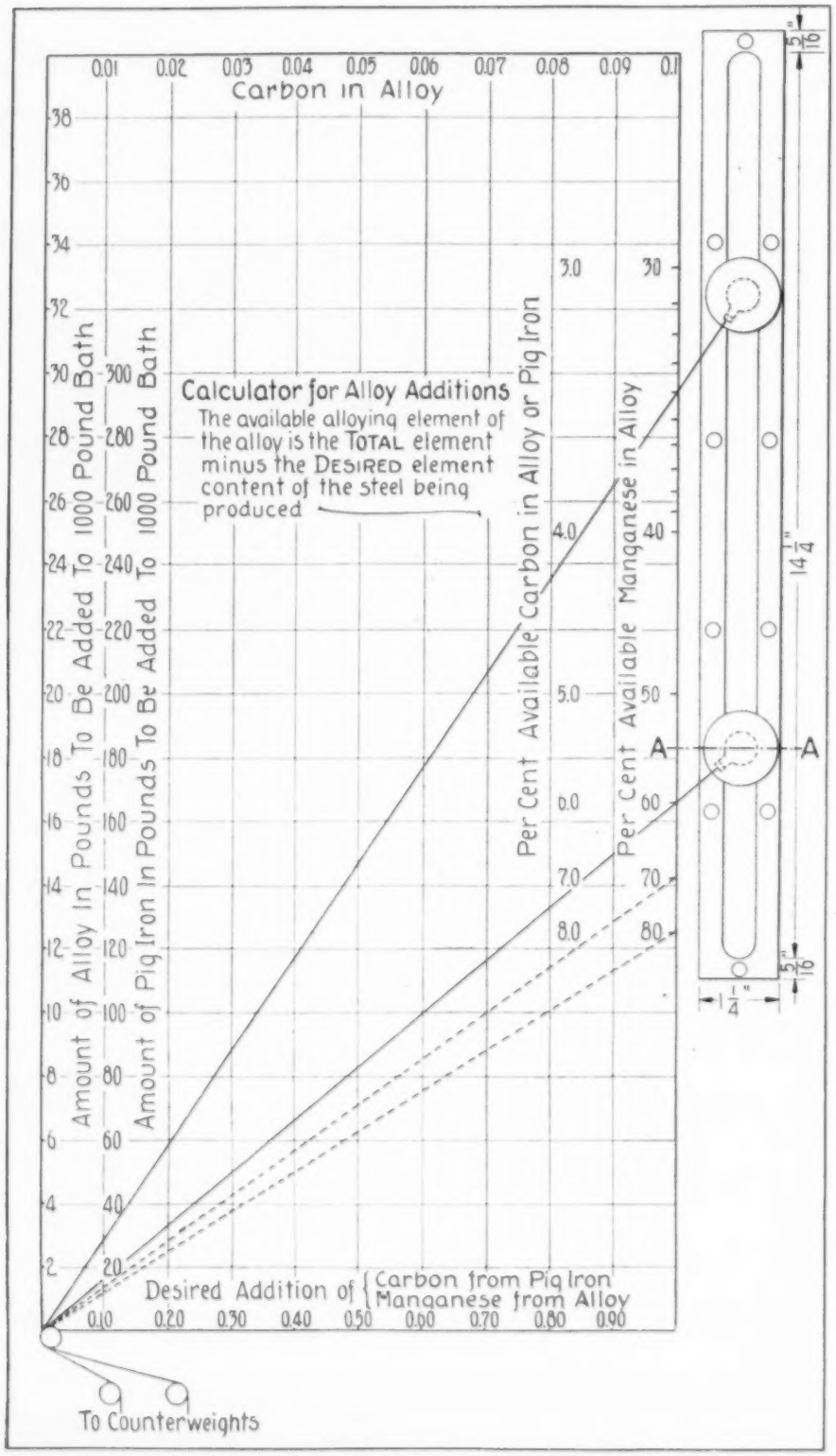

Carbon in Alloy
0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1
Calculator for Alloy Additions
The available alloying element of the alloy is the TOTAL element minus the DESIRED element content of the steel being produced
Amount of Alloy In Pounds To Be Added To 1000 Pound Bath
Amount of Pig Iron In Pounds To Be Added To 1000 Pound Bath
Per Cent Available Carbon in Alloy or Pig Iron
Per Cent Available Manganese in Alloy
Desired Addition of { Carbon from Pig Iron / Manganese from Alloy
0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90
To Counterweights
A
A
5/16"
14 1/4"
5/16"
1 1/4"

FIG. 1—COMPUTING ADDITIONS OF FERROALLOYS OF KNOWN CHEMICAL CONTENT IS FACILITATED BY A CHART SYSTEM

First let me explain what is meant by the *law of availability*, citing a few examples: When a ferroalloy addition is made to a melted charge, the total weight of the bath is increased by exactly the amount of ferroalloy added. Therefore, it is apparent that, to revert to the index figure of 100 used by Mr. Campbell, more than 100 pounds will be the product of the bath plus the addition. Therefore, we see that the alloy has to retain within itself a portion of the special element, thereby decreasing the quantity of such element which it is able to contribute to the remainder of the bath. Probably the most common example which presents itself to the mind is pig iron, and for the purpose of this discussion we will consider pig iron as a ferroalloy, treating it as an alloy of carbon and iron. A few simple calculations will illustrate the significance of availability, particularly if we take as examples a large addition of carbon by pig and a small addition of carbon by the same medium, assuming in each case the carbon content of the bath to be identical. These examples may be taken as follows:

EXAMPLE A

	Per cent
Carbon conent of bath	0.25
Carbon content of pig	3.80
Desired carbon in steel	0.40

EXAMPLE B

	Per cent
Carbon content of bath	0.25
Carbon content of pig	3.80
Desired carbon in steel	0.90

Before proceeding to develop the argument, it is admitted that only on rare occasions would it be found expedient to add such a large amount of carbon by a pig addition, but such occasions do arise and are signalized, unless great care is exercised, by error or omission involved in a loose use of a calculator of the type under discussion.

With example *A* approximately 4¼ pounds per 100 is indicated on the *Campbell calculator*, whereas if the calculation is properly made we obtain a figure of 4.41 pounds per 100. In example *B* the calculator gives a figure of 18 pounds per 100, whereas the correct figure is 22.42 pounds per 100. This is quite a striking example of the necessity for the application of the *law of availability*, but is not so striking as the case presented with the alloy ferromanganese in making manganese steel.

The *law of availability* briefly may

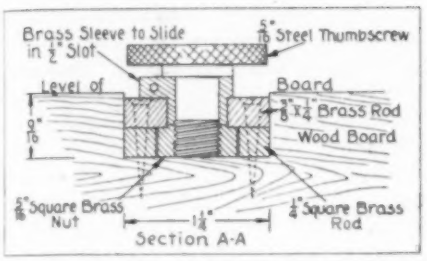


FIG. 2—DEVICE MAY BE CLAMPED IN PLACE BY A SET SCREW

be stated as follows: The available content of an element in an alloy is the total content minus the desired content of the special element in the finished steel. It should be understood that this statement of the law does not take cognizance of oxidation losses which are variables and are provided for by allowances as dictated by experience.

Errors Occur

Reverting now to example *A*, we see that the available content of carbon in the pig iron is 3.40 per cent, being the yield of 3.80 contained in the pig minus 0.40 which is the desired carbon content of the finished steel. Now if this allowance were made the *Campbell calculator* should bring us to a correct figure. In example *B* the available carbon of the pig iron is 2.9 per cent, being found by deducting the desired carbon content in the finished steel, namely 0.90 per cent from the actual carbon content, 3.80 per cent, of the pig. The method of calculation is as follows, taking example *A* first:

EXAMPLE A

Add 0.15 per cent carbon to 100 pounds bath with pig iron containing available carbon 3.40 per cent.

lb. x per cent = lb. per cent
100 X 0.15 = 15

Then:— $\frac{\text{pounds per cent}}{\text{per cent}} = \frac{15}{3.4}$ or —(15 being pounds per cent carbon to be added and 3.4 being the available carbon of the carburizing medium) we get 4.41 pounds.

To prove this calculation we take

100 lb. at 0.25 per cent =	25	lb. per cent.
4.41 lb. at 3.8 per cent =	16.76	lb. per cent.
104.41 lb.	41.76	lb. per cent.

which equals, according to the equation $\frac{\text{pound per cent}}{\text{pound}}$ = per cent, 0.3996 per cent carbon. Therefore, it becomes obvious, that the figure shown by a line laid across the *Campbell calculator* is low.

EXAMPLE B

pound X per cent = pound per cent
100 X 0.65 = 65.0

Then:— $\frac{\text{pound per cent}}{\text{per cent}} = \frac{65}{2.9}$ or — = 22.42 pound pig iron.

To prove the calculation of example B take

100 pound of bath at 0.25 = 25 pound per cent
22.42 pound of pig at 3.8 = 85.196 pound per cent

122.42 pound 110.196 pound per cent = 0.9001 per cent

The *law of availability* must apply in making steels where pure metals are used instead of alloys. For example, the foregoing explanation would indicate that in making 5 per cent nickel steel, chemically pure nickel would only contain 95 per cent available nickel, whereas the same material in making a 20 per cent nickel steel would only contain 80 per cent available nickel and should be figured in such terms for the purpose of making the calculation of the addition. While in the United States the writer made a number of calculators for use by certain steelmakers and these proved useful, particularly on the electric furnace where it was essential that as little time as possible be allowed to elapse between the determination of the contents of the bath and the addition of the finishing alloys. A copy of a calculator for ferromanganese is shown, combined with a calculator for pig iron additions. Working upon the same principles it is easy for any steelmaker to construct his own calculators.

No Figuring Required

Instead of a fixed line, a wire is stretched from the zero point through the marked availability points and therefore, the operator is able to read in terms of addition per quantity that he has taken as his basis for his vertical ordinate. On the ferromanganese calculator the carbon addition which will be made incidental to adding the requisite amount of alloy to bring the manganese up to its desired content also is shown. This, of itself, is useful information and reduces the actual figuring to be done. It should be remembered that when figuring the carbon addition from the ferromanganese, the *law of availability* is just as applicable to the carbon of the ferroalloy as it is to the manganese of the ferroalloy. Two wires will have to be used on this calculator, one being set to the available carbon, the other to the available manganese. Then, having determined the weight of the ferromanganese to be added to raise the manganese content to the desired figure, we read back from weight figure to the carbon line and check up from the carbon line to the carbon content shown at the top. The calculator illustrated is designed for additions of alloy per 1000 pounds charge. It may be found advisable to use wires of different color, say a steel wire for carbon and a copper wire for manganese.

In attempting to make steels as closely as possible to analytical specification, purely with a view to determining oxidation losses, the writer has found it necessary, in some experiments dealing with complex steels in the electric furnace which involve the addition of three or four alloys, to make provision for a final adjustment by adding, with the alloys, an amount of iron to bring about the requisite theoretical adjustment. It will be seen that if chromium, molybdenum, manganese, nickel and pig iron are added we shall have the increment of weight of the alloys last calculated reducing the actual content, in the finished steel, of the previously computed special elements. Therefore, having calculated the weight of the bath and roughly estimated the alloy addition, a somewhat higher figure is taken than the total of bath and alloy, and the calculations of alloy additions are made in relation to the high figure. The difference between the predetermined total figure and the sum of bath, plus alloy additions is added as iron. This figure should be as low as possible. In this case the ultimate weight of the charge is a predetermined figure and the *law of availability* need not apply provided that a final adjustment of iron and pig iron is made to correct the composition and the weight of the charge concurrently.

The combined calculator illustrated deals also with pig iron additions to correct the carbon content after the carbon addition from ferromanganese has been determined. It is preferable to adjust the carbon content of the bath with pig rather than to use the somewhat haphazard and dangerous expedient of anthracite or carbon additions to the ladle.

Details of Chart

The simplest form of chart is drawn on squared paper and pinned to a board, the indicator wires passing over

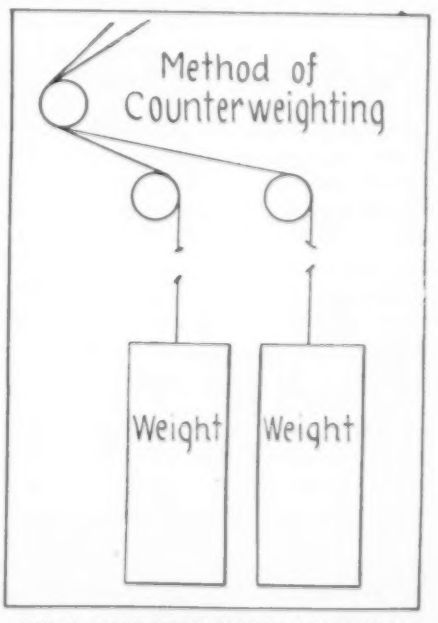


FIG. 3—COUNTERWEIGHTS ARE USED

a peg at the zero point and being attached to the collar on the set screw which rides in the device at the right of the available figures. Details of this groove, set screw and nut are shown on Fig. 2. This is the simplest and cheapest form of calculator, but the writer would recommend that any steelmaker who is making such calculators spend a little extra money and produce charts which will not be defaced by use.

A really serviceable type may be made as follows: The chart, carefully drawn on squared paper, is mounted on a board and a vertical slide, as shown on the ferromanganese calculator, fitted in the board. Above the chart a thin sheet of glass is mounted, between which and the paper are placed thin distance pieces to allow the wires to be moved freely. The wires in this case ride over the zero pin and over a further pin at 45 degrees below and to the right of the zero pin, and have small weights attached as in Fig. 3 to hold them in a straight line. This is necessary as with the vertical adjusting slide the distance between the zero point and the collar on the set screw will vary with the availability of the alloy being used. On the ferromanganese calculator illustrated the carbon figures are shown at the top and the managanese figures at the base, but some operators will find it expedient to introduce a still further refinement by having the *carbon content desired addition* and the *manganese content desired addition* marked on a stout transparent celluloid strip which rides in grooved boards mounted at either side of the cover glass. With such a refinement the indicator strip, say, for manganese, is moved vertically upward until it contracts at the desired addition figure with the manganese line, then, the indicator strip being held truly horizontal, the amount of addition is read off at the left. The carbon index is then brought vertically downward to contact with the leading edge of the manganese indicator strip and the corresponding addition of carbon per cent is read off on the carbon line. The carbon lines and manganese lines are of course, the wires which are set to the correct availabilities.

Locate Points Correctly

A sheet of squared paper, one square to the inch, about 15 x 24 inches will be large enough. Allow a border of one inch all around and lay out the co-ordinate axes, with the *amounts to be added* on the left and the *desired addition* on the bottom of the scale. Then draw a light line horizontally across the paper through point 10. Now through the points on the bottom of the chart erect perpendiculars until they intersect the horizontal line. This will give nine intersections or points. Lines drawn from the zero point and then through each intersection until they cross the right side of the chart will locate the proper place for each available per cent of the alloy. The dotted lines on the chart show the method just explained.

Institute Will Discuss Metal Problems

Iron and steel manufacture together with physical properties and heat treatment problems will be discussed at the autumn meeting of British Iron and Steel Institute. The meeting will be held at University of Birmingham, Birmingham, England, from Sept. 9 to 11. The papers to be presented and the authors are as follows:

The Dilation of Cast Irons During Heating and Cooling, by J. H. Andrew and R. Higgins; High Frequency Induction Furnaces, by D. F. Campbell; Equilibrium at High Temperatures in the Iron-Carbon-Silicon System, by M. L. Becker; The Chromium-Iron Equilibrium in Carbides Recovered from Annealed 2.23 per cent Chrome Steel, by E. D. Campbell and J. F. Ross; Steel Molding Sands and their Behavior under High Temperatures, by A. L. Curtis; The Tensile Properties of Single Iron Crystals and the Influence of Crystal Size upon the Tensile Properties of Iron, by C. A. Edwards and L. B. Pfeil; The Orientation of Crystals Produced by Heating Strained Iron, by C. F. Elam; Ancient Iron from Richborough and Folkestone, by J. Newton Friend and W. E. Thorneycroft; The Effect of Temperature on the Behavior of Iron and Steel in the Notched Bar Impact Text, by R. H. Greaves and J. A. Jones; Notes on the Iron-Nickel and Iron-Cobalt Equilibrium Diagrams, by L. Grent; Reduction of Iron Ores by Hydrogen, by H. Kamura; Blast Furnace Practice in India, with Special Reference to Economy in Coke Consumption, by J. L. Keenan; The Davis Steel Wheel and its Manufacture in England, by W. R. Martin; Retained Austenite, by J. A. Mathews; A New Direct Process, by H. Flodin; The Magnetic and Electrical Properties of Cast Iron by J. H. Partridge; Dendritic Segregation in Iron-Carbon Alloys, by A. Sauveur and V. N. Krivobok; The Influence of Strain and of Heat on the Hardness of Iron and Steel, by A. Sauveur and D. C. Lee.

British Company to Make High Test Iron

A company has been formed in Great Britain under the name of the British Perlit Iron Co., Ltd., with registered offices at 15 Victoria street, London, S. W. I. This company has purchased the British and Colonial patent rights of Heinrich Lanz, Germany, for the manufacture, by his process, of special gray iron.

Among the companies who have already taken a license to manufacture iron by this process are the North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, England, and Alfred Holt & Co., of Liverpool, both of which are represented on the board of directors. Other directors are Hans Meyer of Heinrich Lanz, of Mannheim, Germany, and John A. Smeeton, of Smeeton-Wright Furnaces, Ltd., London, who is the managing director. Mr. Smeeton formerly had the rights of the Lanz process and has disposed of these rights to the newly formed company.

The consulting metallurgist of the company is H. J. Young of the North-Eastern Marine Engineering Co., Ltd., who has made a special study of the Lanz process, and he wrote a paper on the subject, which he delivered at the congress of the Institute of British foundrymen in Glasgow, last June.

Tests Show Aluminum in Metals

Tests have been completed by the bureau of standards of a new method for the rapid detection of small amounts of aluminum in certain nonferrous materials, such as zinc, brass, bronze and bearing metals.

By this method as little as 0.005 per cent of aluminum can be detected in a 1-gram sample in less than 10 minutes, if the amounts of tin and lead do not exceed 10 and 25 per cent, respectively.

In alloys containing higher percentages of these elements, the detection of such small amounts of aluminum is not as satisfactory, and a longer test that requires about 30 minutes gives better results, it is stated.

To Start Manufacturing

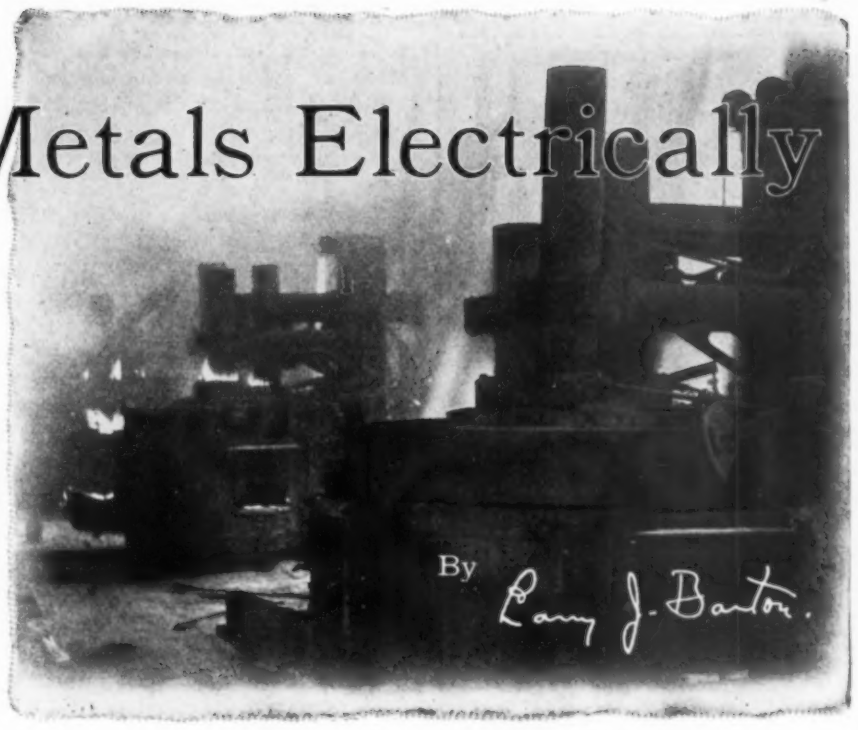
The Pitts Foundry Co. soon will start manufacturing at Fifty-fourth street and First avenue, Woodlawn, Birmingham, Ala. It has leased the foundry formerly operated by the American Blakeslee Co. and will produce gray iron castings, besides making wood and metal patterns. The company is incorporated with $10,000 capital stock with the following officers: President and treasurer Alton V. Pitts; vice president and superintendent G. Johnson; secretary, Attorney A. Wynn Jones. Mr. Pitts formerly was general superintednent of the Kent Machine Co., Kent, O.

Cornell Iron Works Inc., New York, has removed its main office and factory to 71-79 Marion street, Long Island City, N. Y. A branch office will be retained at 601-605 West Twenty-sixth street, New York. The company makes doors and shutters.

Refining Metals Electrically

Chapter VIII (Concluded)

Preparing Stopper Rods — Trouble Shooting Bottom Pour Ladles



AFTER the nozzle is set properly for the bottom pour ladle, the next step is to set the stopper rod. Tis rod is as is shown in Fig. 56, and is ready in accordance with the following procedure. The first step is to note if the iron rod is straight and if the threads are in good condition for the nuts. If so, the stopper head is placed in position on the lower end of this rod by the pin as shown in the illustration. After the pin is in place, the head should be rotated until the nut tightens, giving a tight fit against the lower end of the rod. A handful of either mud, fire clay, or some good refractory cement is rubbed around the top of this graphite head when the first sleeve brick is placed in position and forced as tight as possible against the stopper head. This same process with the mud is used between each of the bricks until the rod is filled as high as desired. The washer then is put on and tightened with a nut until the rod's coating is tight and the cement is being squeezed from the joints. Then the rod is placed on its side and given a coating of the cement, this being rubbed on by hand, and sufficient in amount to fill any small openings between the bricks.

The best material the writer has found for the joints is any refractory cement. These have the ability to resist heat in operation, and also have a natural tendency to bind in place, and do not flake out as is the case with fireclay or mud. Furthermore, when the ladle is being dried, they will heat without cracking badly.

It is unnecessary to mention that the bricks used should always be in first class condition, and fit snugly into each other, and over the stopper head. As each brick is laid, it is good practice to fill the space between the iron rod and the brick with sand, that any slight leak may be stopped before it has a chance to attack the rod. A rod never should be used unless every joint is perfectly tight, as a loose fit is an invitation to the metal to enter, often with bad results.

When the rod is finished, the opening in the bottom of the stopper head should be plugged. This stopper head is graphite and naturally rather soft, with a tendency to give. The greatest trouble is to find some plugging substance which will stand the heat and the action of the metal without burning, and yet at the same time will have an expansion close to that of the graphite so that it will not fall loose when the rod is heated. Many substances are on the market for this purpose, but a satisfactory material may be made in the shop. Take the old stopper heads as they are used and pulverize them. To this powder add sodium silicate until a stiff mud is formed. This is forced into place with the fingers. When a plugged head of this cement has passed through a heat, it is absolutely impossible to tell where the joint has been made, so intimate is the connection. Such a cement will resist heat and the flow of the metal exactly the same as the head itself, and as it is made of the same material it has the same expansion, so that there is never any trouble encountered on this point.

The rod being finished, it is necessary to dry it thoroughly before use. This can be done in almost any oven. In the open-hearth shops, they are dried by leaning against the hot furnace. Some shops dry their rods in the core ovens while others have specially made ovens. Regardless of the equipment, the rod should be dried slowly and when used should be still warm.

Setting The Rod

When a ladle is being made ready for use, the rod always is set before the ladle is heated. The rod is fitted to the gooseneck and so arranged that it will have plenty of play during the heat, note being taken of the fact that the head wears off as the heat progresses and sufficient allowance in added length is taken to cover this feature. The rod is tried several times to assure that it will slip into place easily when the lever is lowered. It then is placed in its final position and again tried at the joint with dry

Prevention's Ounce

WHEN a bottom pour ladle starts to leak, an interesting time is at hand for the ladle man. Many of the difficulties which are encountered in using this type of ladle may be avoided by the observance of proper precautions before the metal is tapped into the ladle. In this section, Mr. Barton gives detailed information on preparing stopper rods for service in bottom pour ladles. He then presents the various classes of disorders to which this type of ladle is heir and offers remedies or preventive measures. Handling the ladle on the floor often is vitally important in securing high class castings. Proper pouring may avoid excessive cleaning room costs and often eliminates shrinkage troubles.

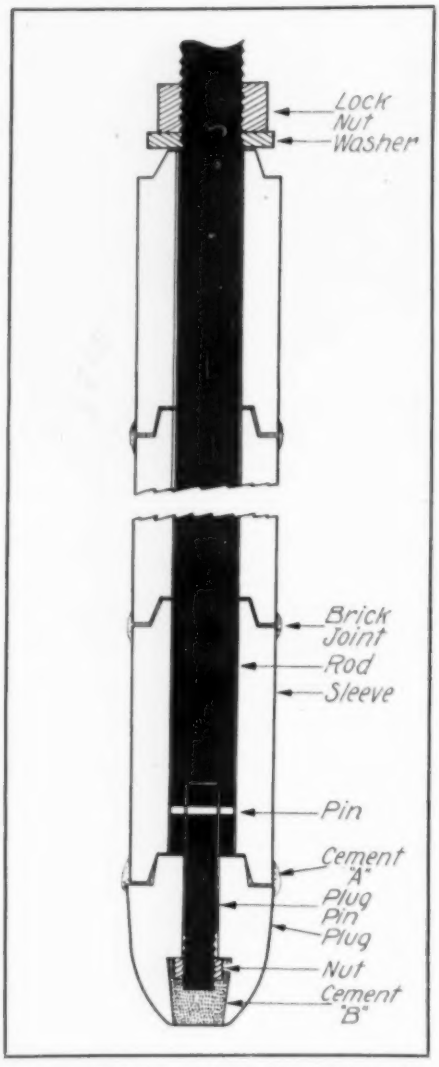


FIG. 56—STOPPER RODS ARE BUILT UP OF HOLLOW REFRACTORY SECTIONS SUPPORTED ON A CENTRAL ROD AND WITH THE JOINTS CEMENTED

sand. If any comes through, the brick should be cleaned carefully and tried again. If sand still leaks, the rod must be rotated against the brick to fit the head into bricks shape which usually will give a good test. As the brick has been tested previously there should be no difficulty on this point, although often a small piece of dirt from the ladle wall will fall and stick against the brick, causing the first leak. As the rod is ground into place, this is forced out and a tight fit results. The rod being satisfactory it is removed and the ladle is ready for heating.

A small piece of steel plate should be placed over the nozzle brick to prevent any possibility of dirt or mud falling and sticking to this brick, or clogging the opening. If this steel has a lug attached with a hole in it, its removal by a long hook is easy. The flame is lighted and the heating of the ladle begins. Bottom-pour ladles always are heated from the top, and commercial types of burner are satisfactory for this purpose. A bottom-pour ladle does not have to be heated to a high temperature, but just enough to insure complete dryness, and to take any chill from its body.

Experience has shown that it only requires 15 to 20 minutes of the flame to prepare a dry ladle for a heat of steel, any time over this period only results in a waste of oil or gas. This type of ladle may be over-heated, resulting in running either the walls or the plate over the nozzle. If any running occurs it is likely to go against the surface of the nozzle resulting in a poor fit with later trouble. If a ladle is thoroughly dry it needs only to be brought up to a dark red. The rod may be finally set 10 or 12 minutes before the pour, when there is plenty of time to insure a careful job. A ladle never should be brought to the furnace for steel without the final sand test.

Encountering Trouble

The foregoing has covered in a general manner the method pursued in the arrangement of a bottom pour ladle preparatory to tapping the furnace. Troubles are bound to happen, but as they are the result of nothing but gross neglect it is best to mention them specifically so that the shop entering this field may be forewarned, and thus armed.

Rod brick splitting is a difficulty caused by only two things: By the nut on the rod being so tight against the brick that there is no chance of expansion being taken up, the pressure breaking the brick; or by the rod being still moist, the steam actually blowing a brick apart when the hot metal strikes it. The result of such an occurrence is that the bare iron rod is exposed to the metal, and if the heat is in any way hot, or medium, the result will be that the metal will burn the rod through, and it will be necessary to finish the pour over the lip.

To avoid as far as possible such an accident, the greatest care should be taken in drying the rods, and the ladleman should be certain that the rod is perfectly dry before it is set in the ladle. The best method of covering this item is to keep all the made-up rods in a certain oven, having at least three or four days supply set at all times. If a system is arranged whereby the rod used has been in the oven three days or more, and is still warm before use it is practically certain that there will be no trouble from moisture.

To avoid any chance of expansion breaking the bricks, the lower nut should be loosened just before the ladle is brought to the furnace allowing at least one-quarter of an inch. As the brick will heat and expand much faster than the interior iron rod this lengthening must be compensated. If the lock nut is sufficiently loose the brick, as they expand, will slide along the rod easily for the small amount of increase due to their rapid heating. If the rod has been made properly there is no danger of the metal lifting the bricks and causing an opening in a joint lower down.

Rod or slag boil is an occurrence that will be found only on heats made by the basic practice, and more especially on those where the slag is of a highly cutting nature, and extremely hot and fluid. This trouble will manifest itself within a few minutes after the metal has been poured into the ladle. A small boil will begin around the rod at the slag line, and may increase in intensity so as to throw considerable slag from the ladle. If the upper layers of the rod are moist, this boil may become violent and at times absolutely dangerous. If such a boil is allowed to continue it will slag off the upper brick, and the hot slag will eat through the rod itself.

The remedy for any such condition is to throw several shovels of lime around the rod as the slag comes

FIG. 57—WHEN THE PLUG BECOMES WELDED TO THE NOZZLE BRICK, BREAKAGE SOMETIMES RESULTS BEFORE THE JOINT IS RELEASED

from the furnace. This will harden and thicken the slag so that there will be small chance of its tending to slag away the rod brick. Naturally a heavy basic slag will eat away the acid rod brick as the heat progresses, but as this slagging action is not centralized, but extends over the entire length of the rod it is seldom cause of any serious trouble.

A stopped nozzle will manifest itself at the first, when the ladle is opened only a dribble, or often no metal at all will come forth. This is caused by something having dropped and closed the opening in the nozzle brick, while the ladel was heating. If just before the final setting of the rod a bar is thrust down through the opening there will never be a chance for this to occur, as any small amount of ladle lining, or dirt will be broken loose. One of the methods of preventing this trouble has been mentioned, using a small steel plate to cover the nozzle while heating the ladle.

If such trouble occurs on the floor, the only remedy is to shut the opening quickly so that there is no chance of metal dribbling down and freezing the opening, and use a pricker to open up the nozzle brick. If dirt can actually be seen, a pointed iron bar will be satisfactory to use to break it loose. If the stream still refuses to run, a wooden plug, attached to a long iron bar should be inserted and the ladle lowered against some heavy mold, etc. The weight of the ladle will drive this wooden rod through any obstruction, and is preferred over an iron bar in that any small metal

FIG. 58—NOZZLE BRICK WHICH ARE NOTCHED RESIST THE TENDENCY TO LIFT IF THE PLUG STICKS

dribble will not freeze against it. Such a procedure is dangerous, to say the least and often results in a ladle which leaks badly.

A ladle which leaks under the furnace is caused by only one thing—a poor setting of the rod. It may have been that a small piece of dirt has stuck to the nozzle brick, or the stopper head, and the ladle still held sand, but when the pressure of the metal was exerted this accretion moved, opening a small orifice through which the metal easily forces its way. Speed is essential to get over the first mold so that the stream will have a chance to wash away any small hanging particles. After several openings such a leak ordinarily will stop, and furnishes difficulty only in proportion to the amount of the leaking stream.

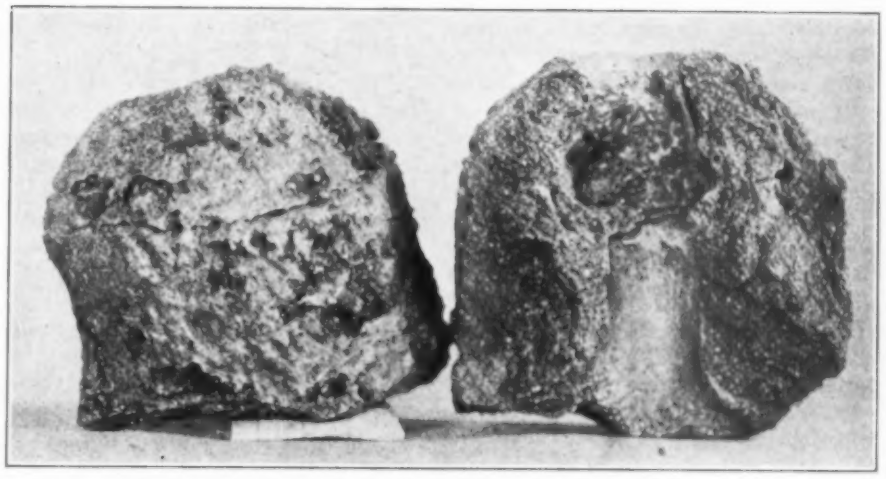


FIG 59—WHEN A STOPPER PLUG BREAKS TROUBLE ENSUES

Plug Cracking

A slight amount of moisture in the graphite stopper head may be the cause of serious trouble, the steam produced under the influence of the metals heat causing the head to split in two. The first opening usually will give a clean shut, but on the second a slight dribble will start, which gradually gets worse as the pouring proceeds until near the end of the pour a bad stream may be leaking from the ladle. As the rod cracks the metal works its way through this crack, gradually enlarging the opening, until often such a heavy stream leaks that it is necessary to tilt the ladle and finish the pour over the lip.

This trouble is more frequent in localities where moisture predominates, in such places as are located in marshy or swampy country, the graphite having a strong tendency to take up a large amount of moisture. The writer has seen instances where rods that had been dried thoroughly and allowed to stand over night in a slightly warm oven, have developed head cracks, although the stopper head itself when it was set in the ladle was still warm to the touch. To overcome any further occurrence of this trouble, the rods should be heated on the head end to a high temperature before being finally set for metal.

One practice adopted to cover this point is as follows. As soon as the rod has been tried in the ladle, and attached to the goose neck, it is removed from the ladle and hung up on end, so that the graphite plug is in a small coke fire, the red hot coke surrounding the entire head. Its closeness to the hot coke is regulated according to the time to be held in such a position the main point being the fact that the stopper head itself should be a fair red when finally lifted and set in the ladle preparatory to the pour. A red hot stopper head never will crack. It offers much less chance of splitting or spalling when the hot metal strikes it. The head helps to preheat the nozzle surface aiding in the prevention of stickers, etc. If the heating is not too prolonged there is no chance of oxidizing the surface and spoiling the set. Before setting in the ladle, such a rod should have the head well brushed with a piece of old sack to insure that no dirt or coke is hanging to the surface.

Plug Burning On Side

As a head is poured the graphite plug burns down considerably, often being reduced a ½-inch in length on a hot heat. Occasionally this burning may take place in an irregular manner, one side of the stopper head burning away faster than the other; or a certain spot may give way quickly. The result is that an opening in the head is left through which the metal passes, causing a leaky ladle. Often, this is caused by a soft spot on the head itself, or it may be caused by the head being scatched or chipped during handling. A small leak will grow in size rapidly especially where the metal is hot, and it often becomes unmanageable. This is hard on the pouring man as often he cannot tell what is causing the leak, and proceeds on the assumption that the seat of the trouble may wash away. By the time the cause appears, the leak may be so bad that considerable metal is lost. A soft head cannot be foreseen, but by taking all possible precautions of examining every rod as made up,

minor cracks, chipped spots, and scratches may be seen, and the head scrapped, or used on a heat where there are only a few stops to be made.

It may happen that the joint between the stopper head and the first sleeve brick becomes loose, allowing the metal to attack the pin which holds the head against the brick. The metal gradually will eat its way through the plug until a clean cut is made. The ladle thus is shut off automatically and must be poured either over the lip, or the plug forced out of the way with a wooden pin and the ladle poured running wide open. This may be caused by the plug in the bottom of the stopped head coming loose allowing the metal gradually to eat through the nut. As this trouble often occurs at about the end or the middle of the heat, it furnishes a mean proposition to handle.

Pin Melting

On extremely hot heats the writer has seen instances where this small steel pin actually melted away from the heat conducted through the stopper head. The amount of heat to which this pin is exposed is considerable and quickly will crystallize the steel to such a point that its strength is low. A pin should be used only two or three times, and should be carefully examined for any traces of weakness each time before it is used.

At least 75 per cent of bottom pour ladle trouble is caused by sticking stopper head. The ladle will pour perfectly on the first opening, but when the attempt is made to open up on the second the rod cannot be lifted. This is caused by the graphite head sticking to the nozzle brick. Often this sticking is light, and the stream can be opened by exerting a little force on the pouring lever, but at times the welding is so tight that force will not open the passage. This welding is caused by the coldness of either the metal, or the nozzle brick. On the first opening the amount of metal which passes through the nozzle is not enough to heat it thoroughly, and when the rod is forced into place it forms a light ring of metal between itself and the brick, which immediately begins to solidify. As this metallic ring solidifies it binds the brick and the head tightly. When force is exerted certain things may happen as follows:

If the ring is light, the ladle will open and the stream will pour forth.

The stopper head may be actually pulled in two.

The pin may be pulled through the stopper head.

The joint may be so tight that the nozzle brick is pulled free from the sand, and slips up and down as the lever is worked.

Fig. 57 shows a stopper head sticking to the nozzle brick. This welding was so tight in this particular instance that the brick had to actually be chipped away for purposes of illustration. Fig. 59 shows a stopper head which has pulled in two.

What Happens Then

A *sticker* offers peculiar results. The writer has seen instances where on the second opening the rod would raise, but no metal would come from the ladle. On inserting a pricker the metal started and the remainder of the heat was poured perfectly, the ladle working in a most excellent manner. Again instances were encountered where the stopper head actually pulled apart, and later welded itself, the heat pouring perfectly. Much depends upon the initial temperature of the metal. If the latter is hot, the heat often will be sufficient to melt away any small obstructions allowing a perfect pour. If the metal is cold the frozen ring may increase offering considerable trouble.

The safest method of avoiding trouble from sticking rods is to have three or four molds lined. The ladle is opened over one of these and as quickly as possible over the remaining few. This rapid movement is a great aid in preventing tight freezing of the ring, and after the ladle has been opened and shut several times this ring has been melted away, and the nozzle brick has been so heated that the formation of another ring is avoided. For heats where large castings are to be poured with cold metal, a large sized nozzle brick is used allowing a quicker passage of the metal. If a delay occurs with the ladle after the first opening, trouble will occur, speed being the best possible precaution against a sticker.

The most serious trouble encountered on sticking rods is caused by the nozzle brick loosening in the ladle, and slipping when the rod is raised and lowered. This makes it impossible to pour from the bottom and lip pouring must be followed. As the sides of a nozzle brick are smooth at the best, this slipping is of frequent occurrence unless some counteracting measures are taken. The remedy is to cut deep grooves in the sides of the nozzle brick before it is set in the ladle bottom. These offer a grip for the sand, and since adopting this remedy the writer never has had a slipping brick. Fig. 58 shows such a brick with the grooving cut.

Frozen nozzles are caused either by the metal being too cold for the size of nozzle used, or by pouring such a small stream that the opening progressively becomes smaller as the metal freezes against the sides until the entire opening is closed and the stream is shut off. If the freezing has been caused by cold metal there is nothing which can be done outside of lip pouring; but if the freezing occurs while the metal still is hot the opening can be burned out by using an ordinary acetylene torch. Any freezing of the nozzle is caused by carelessness as it can be easily seen in advance, when there is plenty of time to go to heavier molds. Its first indication is when small drops from the ladle begin to freeze slightly onto the nozzle ring, requiring the use of a light bar to pry loose. These accretions enlarge until complete closing results.

Handling The Ladle

Assuming that the ladle has been filled with fairly hot metal and is ready for pouring, the first step is to get the ladle centered over the first mold, the nozzle being perfectly centered on the pouring cup. The size and make up of this first mold is important. It should be large enough to take at least 150 to 250 pounds of metal, figuring on a 3 to 4-ton heat in the ladle. It should be a casting with a minimum of cores as it is apt to cut badly. While a large casting is preferable, it never should be used on account of the high temperature of the metal at this time. This first casting should be lined up with several others in case a dribble occurs when the ladle may be quickly placed over the second cup, and then another until a clean shut is assured.

On opening the ladle at first, a fair stream should be given until at least 100 pounds of metal has poured when the stream should be rapidly shut off. If a clean shut is obtained the casting can be finished and the ladle moved. However, if the nozzle dribbles, due to a little dirt or cold metal being against the head or the nozzle, the rod should be opened and closed several times until this foreign matter is removed. If the mold is filled and the ladle still dribbles, the only thing to do is to get over the next mold as rapidly as possible and repeat this opening and closing. In the majority of cases a clean shut will be obtained on the first opening, but there will be times when a dribble will start which will continue throughout the remainder of the pour.

(*Concluded on Page* 708)

How and Why in Brass Founding

By Charles Vickers

Slip Ring Mixture

We would like to know the best mixture for rotary slip rings and the most satisfactory method of melting and casting them. We have been using the gunmetal 88-10-2 *but have experienced much trouble from porosity and oxide inclusions. We use electrolytic copper melted twice and gunmetal scrap, and cast at, from* 1150 *to* 1220 *degrees Cent. into a dry sand mold. Just prior to casting we add* ¾ *pound of* 10 *per cent phosphor copper. The rings are cast in the form of a cylinder,* 2 *feet external diameter and* 2 *feet* 6 *inches long, with a core* 18 *inches diameter, thus leaving a metal thickness of* 3 *inches.*

The ideal metal for a slip ring should combine a low frictional loss with high electrical conductivity which at present is not possible. Therefore a compromise has to be arrived at by employing a bronze which will not heat unduly due to the passage of the current and as little as possible from friction.

The alloy 88-10-2 frequently is specified for the purpose and sometimes a phosphor bronze also is used. Some authorities maintain that to get high electrical conductivity with such alloys, only the purest metals should be used in their composition. While it is not difficult to understand the necessity for purity of the primary metal in the case of copper for castings, it is anything but easy to see why such should be insisted upon in the case of bronzes, and especially phosphor bronze.

As a matter of fact high electrical conductivity has to be dispensed with largely for slip ring metal, because this property of copper is greatly reduced by fractions of a per cent of other metals; thus an addition of 0.25 per cent of either tin or zinc results in around a 25 per cent loss of conductivity in copper, the two metals having about the same effect. The conductivity is decreased further by greater additions until there is little to choose between commercial alloys on the score of electrical conductivity; one being about as good as another. As difficulty is being experienced in this case with the 88-10-2 alloy even when phosphorized, it is advisable to make a change, and the following alloy can be relied upon to cast soundly if melted with ordinary care: Copper 89.50 per cent; tin 10.00 per cent; manganese copper 0.50 per cent. The manganese copper should contain 30 per cent manganese, and it is added when the copper is molten and is given a few minutes to act in a deoxidizing capacity before the tin is added. This will give sound metal. As far as the mold is concerned much depends upon the sand that is used. Let it be open in texture and of a loamy character to permit free escape of the gases and withstand the weight and heat of the metal without disintegration of the mold surfaces. The amount of phosphor copper now being used in the 88-10-2 is too high and likely to produce porosity. Two ounces per 100 pounds alloy is ample. The alloy with manganese copper should be poured the higher temperature mentioned.

Making Small Cores

We are making bronze hinges in sand molds and find that considerable time may be saved by coring the pin holes and reaming them to size. As the cores are small in diameter we are using iron wire ⅛-inch diameter coated with molasses water and graphite and drawn through a 5/32*-inch hole. However, these cores give trouble having a tendency to blow. We would like to learn of some other way of coring these holes, and have thought that perhaps heavy lead pencil lead would be suitable.*

It would be easy to experiment with the heavy lead pencil lead and thus determine whether such material would be suitable for coring the holes. It is likely though they would blow if not warmed, as the moisture from the sand would condense on them the same as it does on the graphite-coated wire. Cores of small diameter such as mentioned may be made satisfactorily by taking wires of the proper diameter and then dipping them in linseed oil. While the wires are wet with oil they are dusted with fine, dry sharp sand, some of which will adhere to the wire. In this manner the wire is covered completely with sand about one grain thick. The coated wires are laid on supports on a core plate and baked like any other oil-sand cores. Such cores will not blow except from absorbing moisture.

Graphite Cores Offer Many Difficulties

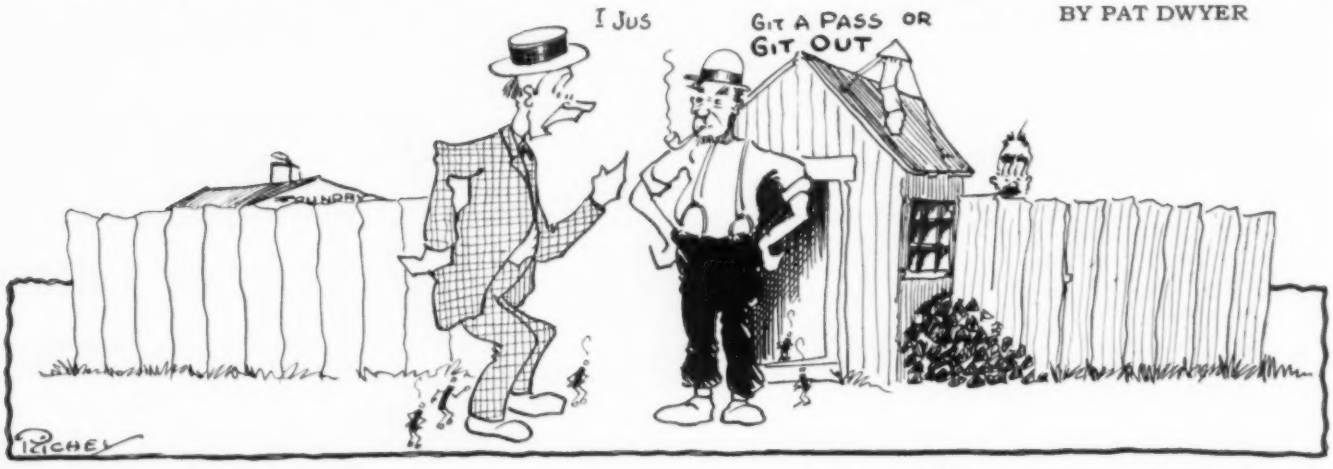
We make bronze castings that must be smooth and have found that as far as the cores are concerned the application of any good blacking will give smooth surfaced castings. However, with some castings the blacking cannot be applied satisfactorily and it has occurred to us that it would be possible to use graphite for the cores and so get the smooth surface the necessity of applying blacking. It might be practical to make the cores of molded graphite, and we wonder if this would be too hard to remove from the castings.

Graphitic carbon is a substance that may be cut and machined like wood. The electrodes for electric furnaces, especially for brass melting, are made of this substance. It is too hard to be used for cores, since it will crack the castings. If successful, its use would be too expensive as it could be used only once in the interior of a casting, and then would have to be drilled out. In the powdered form it may be used like sand for making molds and cores, but it has to be bonded the same as core sand. Apart from its superior heat conducting qualities it would work exactly like sand, that is, it would have to form a porous core, so the gas from the binder could escape. This means the cores probably would require blacking on the surface to close the pores on smooth castings. However, it is a fertile field for experimental work. As far as producing smooth surfaced castings is concerned, core sand is as good as graphite. The latter would have to be bonded. It might pack closer than some sands, but that would mean blown castings, and the same result would be attained using fine sand.

It is possible that a core could be made that would result in smooth surfaces by the use of a large proportion of molding sand, or by using molding sand entirely in place of the sharp core sand. It would be necessary to use as little bonding material as possible to keep down the generation of gases, or to use some bonding substance that would produce little gas, such as glue as the less gas generated the less chance for blowing of the core due to poor venting.

Bill Gives Advice on a Plunger Casting

BY PAT DWYER



FOR the past two weeks Bill has been away on a vacation and naturally when he draped himself over two chairs on the veranda last night I expected to be entertained with a recital of his adventures. I was not disappointed. Accompanied by his wife he had gone to New York by the way of Pittsburgh and Philadelphia and had returned by way of Albany, Buffalo and Niagara Falls. Part of the journey had been by rail and the remainder by boat. He had many amusing comments to make on the various points of interest, but he seemed to get the greatest kick out of a visit he paid to a foundry.

I mildly suggested that I could not see any sense in visiting a foundry. Surely after being stuck in a foundry for fifty weeks in a year he should be glad of the chance to keep as far away as possible for the only two weeks on which he was free to go where he pleased.

"Well" said Bill "I'll tell you. We had been out late one night and on the following morning the Missus decided she would rest up a bit. Her idea of a restful morning was to go to a hair dresser's and maybe do a little shopping. Funny notions some people have. That was the first opportunity I had to spend a few hours by myself and I decided to visit a friend of mine who had charge of a foundry in the city. We had worked together at one time, but had not seen each other for several years. I had the address, but when I arrived I found that the office formed a part of the old plant comprising a machine and erection shop, while the new foundry was located at a point about a mile distant. "After I had stated my business to a haughty beauty at the information desk, a statement by the way which included my name and address, my present connection and many other interesting details which to my mind were totally irrelevant to the point at issue, I was passed along to the private office of the advertising manager. This gentleman eyed me suspiciously at first, but when I had convinced him of the purity of my motives and that I had not the slightest intention of stealing the cupola or of walking away with one of the cranes under my arm, he graciously unbent and launched into a glowing account of the superiority of the product made by his company. He showed me photographs of the machines and of the foundry inside and out and gently intimated that with this knowledge at my disposal I would not find it necessary to visit the foundry. I told him that I quite appreciated his courtesy, but that as my primary object was to see my old friend I felt that it really was necessary to visit the foundry in person.

"Somewhat grudgingly, I thought, he admitted the logic of my argument and bowed me out. He gave me directions how to find the place, but cannily neglected to furnish me with a pass. I made a mental note of this oversight at the time, but reflected that he probably was more familiar than I with the office routine, and therefore I did not remind him, but proceeded blithely on my way. When I arrived at the gate I found that he had—as the saying goes—put one over on me. I was stopped by a wizened, crabby little old Irishman who looked and acted as if he usually slept in a vinegar barrel. If he was pleased to see visitors he was a master hand at concealing his feelings. In my touring days frequently have I received a more cordial reception from a vicious and hungry dog. Between barks I told him who I was, and who I wanted to see and tried to impress him with the information that I had permission from the general office. He informed me sourly that didn't make no difference to him. He had his orthers not to admit nobody who didn't have no pass. He had no time to sthand there arguin' with me, aither git a pass or git out about your business. Sweet old timer, eh?

"'Through one reason and another' I said to him 'I am slightly out of practice and it might be that my ear for accent is not perfectly true, but if you will allow me the privilege of making one guess I'll say you came from Tipperary.' 'What do you know about Tipperary?' says the ancient one. 'Friend of my youth' I said, tapping him familiarly in the general vicinity of his withered old wishbone 'If you will be so kind as to retire for a moment into your cute little dog house I'll give you the high sign. I'll show you what I know.

THE CUSTOMER ALWAYS IS RIGHT

"He retired to his gate house muttering and banged the door. I followed about half a minute afterward. Without the formality of knocking I opened the door with one hand, lifted my hat with the other and favored him with the old and at one time familiar Irish salutation: 'God save all here!'

"The old man jumped to his feet as if he had been galvanized. The tears welled into his ferrety little eyes, now opened wide in incredulous amazement and involuntarily he came back with the response that children over there have learned at their mother's knee ever since the days of Brian Boru. 'God save ye kindly' says he.

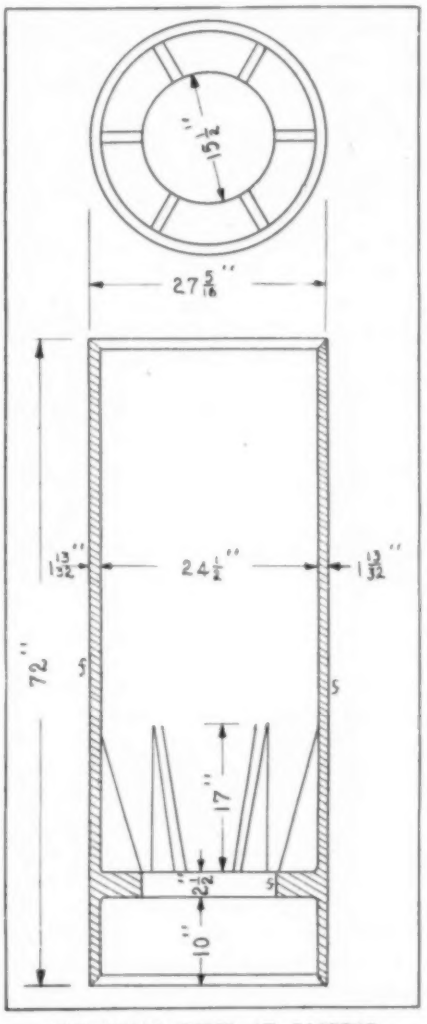
"'Sit down me boy' said he. 'Sit ye down. Musha, but its many and many the long year since I heard them words in me father's little house be the side av the Kerry road near Clonmel.'

"When I told him that I also at one time had lived on the same Kerry road, he at first professed doubt, but when I carried him back in imagination for a tour around the town his vinegary personality vanished and I found myself in the presence of a kindly and tender hearted old man with an almost childish affection for a native land that he had not seen for forty years.

"We spent a delightful half hour together. In fancy we walked through the Main Yard where the fairs are held every week. We saw the West Gate with the marks of Cromwell's cannon-shot in the arch and sides and were greatly pleased to find that our estimate of this gentleman agreed in every particular. We saw the river Suir flowing placidly through the center of the town, carrying on its broad bosom the big barges that were towed up from Waterford loaded with cargoes of salt, coal and the yellow corn that came from far off America. We compared the merits of the high bridge, the old bridge and the new bridge that spanned the river at points about a mile apart. Looking back now I realize that the term new was only comparative. The keystone bore a date that indicated the bridge had been built about 40 years before my time. For all I know to the contrary the old bridge might have been built by the engineering corps of Caesar's foreign legions. The centuries lie lightly on the little green isle across the sea where the inhabitants still refer familiarly to the exploits of champions who measured swords with the Phoenicians. Finally I arose to go and expressed my genuine pleasure at the fortuitous chance that had led me to form his acquaintance.

"'Hould on' says the old reformed crab. 'Who was it ye said ye wanted to see?'

"I informed him generously that the point really was immaterial. I had come out originally with intention of visiting my old friend the foundry superintendent, but I fully realized the responsibility of the gateman's position and I would not think for a minute of flying in the face of duly constituted authority.



SECTIONAL VIEW OF CASTING

"'Go an in' said he with a fine open handed gesture. 'Go in an' shtay as long as ye like. If any iv thim impident young gyards axes ye any questions, tell him to go to the divil!'

"The foundry superintendent received me with open arms and took a commendable pride in conducting me personally over his extremely well appointed shop. On the way out I stopped again at the gate house to exchange a few further reminiscences with the ancient guardian of the citadel. I found him puffing contentedly on a little short, black clay pipe. I told him I believed I would treat myself to a *shaugh* of the pipe with him and by the manner in which he nodded approval as I filled an old veteran cob pipe with the real he-man tobacco I realized that I was numbered among the elect. God was in his heaven and all was well with the world.

"Upon comparing notes I learned that he had sailed out of Queenstown harbor about the time I was floundering timidly through the first reader in imminent danger of shipwreck every day over awe inspiring words of more than one syllable. He naively admitted that his exit was made hurriedly and as a result of a slight misunderstanding. In company with a number of other light hearted gossoons he had croosted the peelers with rocks when a squad of these guardians of the peace had interferred in a little friendly row. Later to his dismay he found out that the Royal Irish constabulary is not a body with which a person may take liberties. The prospect of facing trial with a long term as a guest of her most gracious majesty, Queen Victoria, in one of her penal settlements beyond the sea did not appeal to him. Quite sensibly he decided that if he had to cross the ocean he would choose his own mode of conveyance and pick out a spot to his own liking on which to land. He slipped down to Queenstown and in due time in company with hundreds of others who for one reason or another had been forced to quit their native land, he passed through Castle Garden and hunted himself a job.

"'Back in the ould dart' he said 'I used to work in a shoe sthore, so natherally I looked for the same kind av a job in New York. I got wan down an the lower aist side and kep' it for several years but finally gev it up. The ould customers moved away and the new wans who moved in, bad luck to 'em, could spake naither English nor Irish. The haythins just grunt at wan another an' do most iv their talkin' wud their hands.

"'Sellin' shoes in this counthry is a different job from sellin' 'em in Ireland. Over here a man comes in the shop an' axes to see wan or maybe two or three pairs. He picks wan up, lays down his money and is gone in a few minits. Over in Ireland, Glory be to God, it's almost a day's job to sell a pair. A customer is not satisfied until he sees ivery pair of boots in the shop. He insists on thryin' an ivery pair that by any conceivable

chance can be jammed an his ould yallah feet. The clark has to lace ivery right hand shoe from the bottom to the top. Thin he has to lace ivery left hand shoe from the bottom to the top and then tie the laces in a nate bow knot.

"'The customer reserves judgment 'til the last pair has been removed and his feet once more are laced up in the ould pair he wore upon his inthrance. Thin he commences hagglin' over the price and finally walks out with the remark that he intinds to thry a few more shops before he makes up his mind. Just to show that his heart is in the right place he says that maybe he will dhrop in agin in a day or two! Ah, yis, buying a pair of shoes over there is quite an ivint.'

"From selling shoes the old boy drifted into many other jobs and I believe that if I had the time he would have regaled me for the remainder of the day. However, I had promised to return to the hotel by noon and although I had little expectation of the party of the second part fulfilling her part of the agreement by being there on time, still miracles sometimes happen and I was taking no chances. The gateman and I parted on the best of terms. In fact he gave me a pressing invitation to come in to see him if ever I should find myself again in that part of the country."

"I suppose" I said inquiringly "there is some sort of moral to be drawn from the tale, but it seems to me you took kind of a round about way of getting into the shop. It would have been far easier to secure a pass in the first place and gone in about your business in a straight forward manner."

"My dear Simple Simon" said Bill "I might quote the well known proverb of scattering pearls, but I am afraid it would slip through your literal minded fingers. You seem to miss the important point that in addition to accomplishing my original purpose in visiting the foundry I had a few hours fun. Life may be real and life may be earnest, but remember, dear lad we are only going through the journey once. Have you ever looked at the problem from that angle?

"Several important lessons may be extracted from the foregoing episode. The first is that a judicious application of the old oil greatly facilitates our progress through this vale of tears. The second has particular application to many problems that arise in the foundry. Where duplicate castings are made continuously no trouble is experienced in their production. Where one is only made occasionally the foundryman frequently finds himself with a man's size job on his hands.

"Just take a look at this sketch of a pump plunger. The man who attempted to make it ran into all kinds of trouble. He told me that the casting apparently was perfect when it left the mold and defects only made their appearance in the shape of a honeycomb structure after a cut had been taken in the lathe. The casting was poured on end without a cope. The cupola charge was made up of 400 pounds of pig iron, 500 pounds of good machinery scrap and 300 pounds of steel scrap. The pig iron analyzed silicon 2.75 per cent, sulphur 0.05 per cent, phosphorus 0.60 to 1.00 per cent manganese 0.40 per cent. He did not state whether the mold was made in green or dry sand.

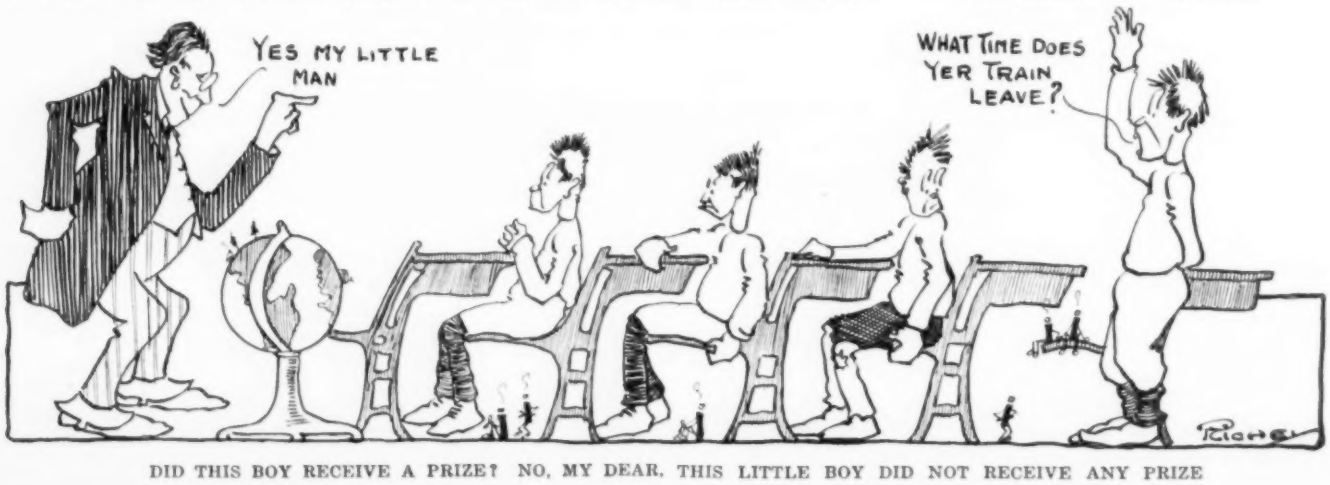
"Naturally, I pointed out that the trouble might be due to one or a combination of several causes. The symptoms mentioned may be found in a casting poured in a wet mold, a hard mold or a mold made from close sand not vented sufficiently. The trouble may be due directly to oxidized iron or it may be due in a measure to perfectly good iron allowed to cool by pouring too slowly. It may be made in a green mold, a skin dried mold or in a dry sand mold provided proper precautions are observed, but manifestly if the mold was made in dry sand I should be wasting my time dwelling on the many pitfalls that lie in wait for the green sand molder. The same objection holds true with the gating system adopted. Under certain conditions a casting of this kind properly might be gated at the bottom with satisfactory results. Under certain other circumstances the method would be suicidal.

"Assuming that the casting is made in a dry sand mold with the core made separately and lowered into place after the mold is dried, the core is the most probable cause of the trouble. More than the usual amount of gas is generated on account of the manner in which the iron completly encircles the core and enters the many brackets. If no extra provision is made for the rapid escape of this gas some of it will attempt to escape through the iron. Where the iron is poured through a single gate at the bottom the flow of metal is so slow that it becomes dull and tends to hold some of the gas in the form of bubbles. The iron forms a skin against the face of the mold and although it is slight it is sufficient to resist the escape of the gas.

"The obvious remedy is to make the core as porous as possible and to pour the iron hot and rapidly. This latter feature is best accomplished through six ¾-inch pop gates spaced at equidistant points on the top edge. Where the molding sand is too close it is advisable to add a quantity of sharp sand to the facing sand mixture and also vent the sand forming the body of the mold either with a vent wire or by using a layer of cinders.

"I pointed out that perhaps his pattern and rigging represented quite

(*Concluded on Page* 713)



DID THIS BOY RECEIVE A PRIZE? NO, MY DEAR, THIS LITTLE BOY DID NOT RECEIVE ANY PRIZE

Patternmaker Finds Saw Basic Tool

From the Time the Tree Is Cut in the Forest Until the Pattern Leaves the Shop, the Saw Continually Is Employed for Various Operations

By Walter C. Ewalt

THE saw is an instrument of great antiquity. Mythology, tradition, ancient paintings and discoveries indicate that the implement was used from the earliest ages by prehistoric man. It is told in Grecian mythology that the inventor of the saw once found the jaw bone of a snake and used it to cut through a piece of wood. The myth states that Talus was the inventor and that his uncle Daedalus was so jealous of this great discovery that he killed his nephew. Another writer says that the back bone of a fish was employed in the great discovery.

It may seem reasonable to suppose that at the dawn of mankind, some hairy, skin-clad ancestor picked up the jaw bone of an atlantosus or an uopounby and in an idle moment pulled the teeth against a tree and discovered a saw. This led to a fast and fine way to make a war club or a persuader stick to dent some fair maiden's skull he wanted for a mate.

As proof of their great antiquity, saws of the bronze age have been discovered in Germany and Denmark. The metal was cast or hammered thin and was serrated by chipping and grinding. Saws of a still greater age, probably the stone age, were made by setting flakes of flint in wooden handles and securing with bitumin. It is said that saws of obsidian were used in Mexico. Saws of obsidian have been discovered in the alluvial ground of New Jersey, beneath the recent gravel. As Mexico was the nearest place that obsidian could be obtained, it proves that ages ago travel and trade were carried on between these two distant places. The saws of the South Sea Islanders were made of shark's teeth. Saws have been made of jagged flint and others of notched shells. Ancient paintings at Thebes shows a saw being used and at the same place a bronze saw was discovered which now is in the British museum. It is so old that its owner lived before the time of Pythagoras, and like the saws used by us today, it was operated by a thrust

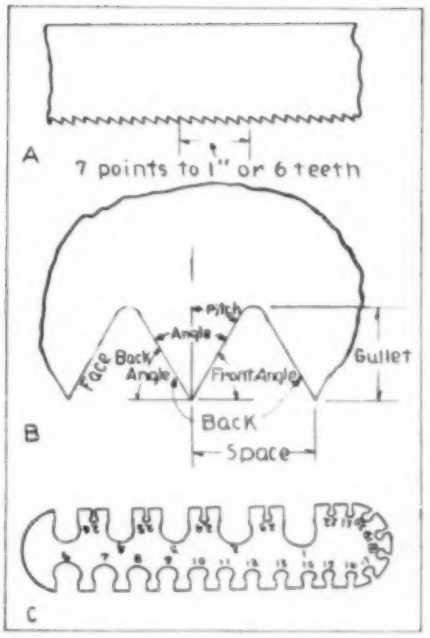


FIG. 2—*A* POINTS TO THE INCH, *B* DETERMINING THE PITCH, *C* GAGE

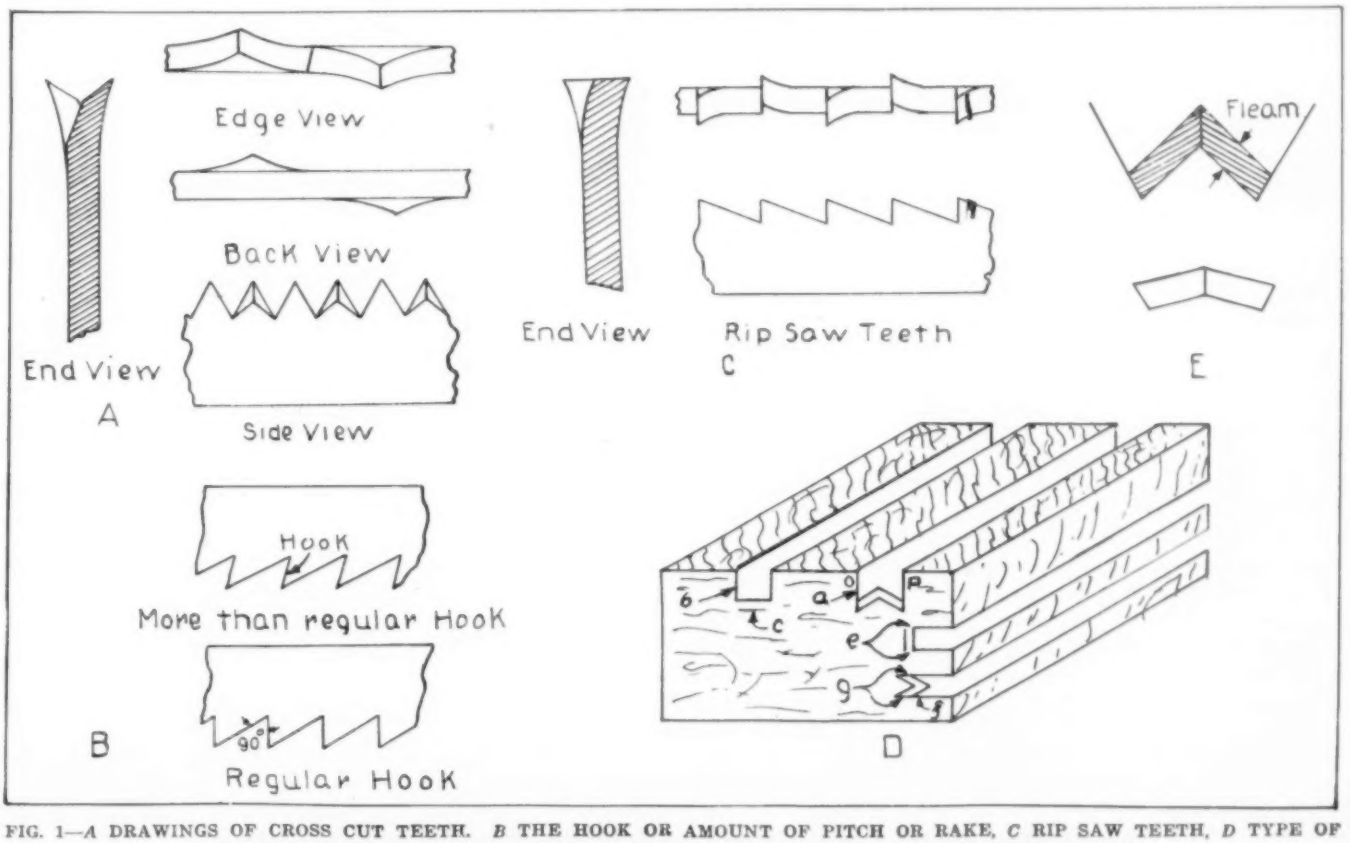


FIG. 1—*A* DRAWINGS OF CROSS CUT TEETH. *B* THE HOOK OR AMOUNT OF PITCH OR RAKE, *C* RIP SAW TEETH, *D* TYPE OF CUTS MADE BY VARIOUS TEETH, *E* THE SIDE ANGLE OF THE TOOTH OR THE FLEAM

movement. An iron saw has been discovered at Nimroud.

It is said in Hebrew history, that the stones with which the architects built Solomon's temple were squared with a saw. Japanese, Chinese and most people living in eastern countries build saws shaped like a butcher's cleaver. The saws cut by being pulled toward the operator, just opposite from the type used in this country, which cuts when pushed away from the operator.

In a conversation with a pattern maker born and raised in Europe, the author asked him concerning the kinds of saws used in the country from which he came. He told of ripping logs where one end of the log was elevated from the ground on a saw horse and two men used a saw, one standing on the ground and the other on top of the log. The saw was of thin steel and the teeth were filed so that it cut when drawn, not pushed, towards the operator on the ground. All of the work done by the man on top of the log was to pull the weight of the saw up ready for another downward stroke. Laughingly, the narrator said the man on top was always the boss, meaning the boss was the one who succeeded in getting on top and also the one who had the easiest work. However, he corrected this statement later by saying the boss was responsible for guiding and making the cut straight.

In crossing to this country, he saw a tool in the ship carpenter's kit which looked something like the saws he had used. He asked the carpenter what the tool was called and what it was used for and received the answer that it was an American saw and was used to cut wood.

He thinks our saws are a great improvement over the ones he used in the old country. As it is 40 years since he came here, it is possible that the style of saws have changed in his former home.

As stated before, most of the eastern countries use saws that are drawn toward the operator instead of being pushed, which allows the blade to be much thinner than ours and consequently less wood has to be cut out of the kerf. If our saws were as thin, they could not stand the thrust to which they are subjected. It may be imagined that using a saw which cuts when being pulled toward the operator would be awkward and fatiguing as it seems much easier to push than it is to pull a saw. The saw, as we know it, is made heavier to withstand the pushing effort, the blade being made heavier so that it will not bend too readily. Instead of added weight at the point of the saw, as required in those of the pulling type, the blade is tapered toward the point, the blade also gradually becoming thinner toward the point. The part of the blade nearest the handle is the thickest. Another well-thought idea was in making a taper from the teeth to the back, giving the saw blade more clearance the deeper it enters into the wood.

Telling Temper of Saw

Some workmen profess to tell whether a saw is of the right temper by holding it by the handle with one hand and tapping the saw near the point with the finger of the other hand and listening to the kind of sound produced. However, after listening to a saw fiddler at the theater, the writer is convinced that any sound or any tune from middle *C* to high *G*, from the *Anvil Chorus* to *I got a new kind of a man* may be produced. A better way is to test by setting and filing and bending the blade. The blade when bent should form a smooth regular curve, if uneven it shows it is heavy in spots or not tempered the same throughout. The blade should be straight and true when returned to its original shape which easily may be seen by sighting down the teeth and back.

The terms used in describing a saw are as follows.

Space—The distance from one tooth to the other measured from point to point, shown in Fig. 2*B*.

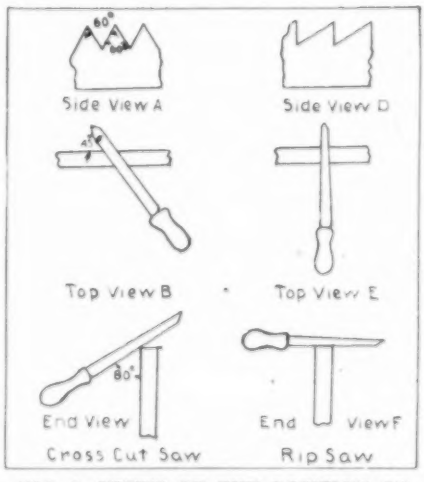


FIG. 3—VIEWS OF THE POSITION OF THE FILE WHILE FILING

Pitch or Rake—The inclination or the angle of the face of a tooth, measured from a vertical line drawn through its point, shown in Fig. 2*B*.

Face—The cutting edge of the tooth or the front of a tooth, illustrated in Fig. 2*B*.

Back—The back edge of the tooth. This term is sometimes used when speaking of the opposite edge of the saw from the teeth edge, shown in Figs. 2*A* and *B*.

Gullet—The depth of the tooth from point to the root line, sometimes called the throat. In most places it is thought of as the hollow at the base of the tooth below and between the face or cutting edge and the back, shown in Fig. 2*B*.

Gage—The thickness of the blade, usually measured by the English standard wire gage, illustrated in Fig. 2*C*.

Run—A condition where the saw does not follow the line.

Set—The amount of lateral inclination the teeth are bent to the right and left of the plane of the blade, shown in Fig. 1*A*.

Fleam—The side angle of a tooth, shown in Fig. 1*E*.

Points—The number of points of teeth to the inch, shown in Fig. 2*A*. The number of points to the inch regulates the size of the teeth and therefore the degree of fineness or coarseness and should be specified when ordering a saw. It will be observed in Fig. 2*A*, there is one less tooth per inch than there are points.

Angle—That part of the tooth which is included in its point between the face and back, shown in Fig. 2*B* There is no arbitrary rule for making the angle. Different filers use various angle of teeth but the general angle is 60 degrees. It may vary according to the kind of wood and ranges from 40 to 90 degrees. The front angle in soft woods and for ripping may be greater than that made for hardwoods and cross cutting.

Pitch—The angle obtained by subtracting the back angle from the front angle, shown in Fig. 2*B*.

Blade—All of the steel part of the saw.

Hook—The amount of pitch or rake, shown in 1*B*, and usually indicates that the front angle is more than 90 degrees.

Handle—The part of the saw, grasped by the hand when operating the saw.

Cross cut saw—A saw with teeth formed to cut at right angles to the grain of the wood shown in Fig. 1A.

Ripping saw—A saw with teeth formed to cut in line with the grain of wood, shown in Fig. 1*C*. This is the same as the cross cut saw with the exception of the teeth.

Heel—The handle end of the saw blade.

Point—The opposite end from the handle.

Gumming—Filing or grinding the bottom of the gullet round to pre-

vent the starting of cracks, which are caused by sharp corners.

The saw probably is the most important tool used by wood workers. Some form of saw is used for falling the tree, cutting the logs into planks and by the patternmaker in making the finished pattern by cutting the planks to a size with the hand, band and circle saws.

Use Differently Formed Teeth

The terms used are common to all kinds of saws. The duty a saw performs is to cut the fibre of the wood, the loosened wood being crumbled and forced back and carried out in the gullet of the teeth.

As two extreme conditions arise in cutting wood, first cutting across the grain and second with the grain, it follows that two different forms of teeth should be employed. The wood is removed by the cross cut saw by the cutting action of the sides of the teeth while the full width of the tooth is employed in removing the wood in rip sawing. While it is true that a combination tooth has been designed for both cross and rip sawing, it has never met with much success with the workman. Teeth vary in length, spacing, angle, rake, set, fleam, and form of gullet, according to the kind of wood and the individual preference of the workman. Nevertheless, all are based on the action of the wedge and resemble somewhat the action caused by a chisel since the individual tooth is made of a small weak section of steel, it necessitates a different form than the chisel to obtain strength.

The cross cut must sever the fibres similar to the shearing cut of a chisel or in other words like a knife, while the rip saw acts like a series of chisels, each tooth cutting and separating the longitudinal fibres as one would chisel end grain. It should be noted that the word similar is used in comparing a tooth with a chisel. If the chisel was ground as blunt as a tooth, it would not cut, the reason the saw cuts is because of the many teeth that follow one another, and extremely small portion of wood being cut by each tooth.

The difference between the cross cut and rip saw is shown clearly by the angles of the teeth. In Fig. 1*D*, it will be noticed at *a* that the kerf is across the grain. One tooth on one side and the next tooth on the other side cuts the lengthwise fibres between *O* and *P*. The points cut the fibres and the wood is removed by the thicker part of the tooth which follows. If the rip saw is used in cutting across the grains as at *b*, the edge of the tooth will start as at *c* and as there is no edge to cut at either end of line *c* the fibres will be broken off, making a difficult as well as a rough job.

The action of the rip saw with the fibres longthwise is shown in Fig. 1*D*. Here it is a comparatively easy matter to break the extreme short lengthwise fibres, as shown at e. The action of a cross cut tooth is shown

FIG. 4—TOP FILING OR JOINTING BLOCK

with the grain lengthwise at *f*. This cuts along the line *g* but the tooth cutting across the grains as at *b*, the rip saw is used across the grain, and it does not cut the lengthwise fibres readily.

Teeth Should Be Set

It is necessary to set the teeth of all the saws, except a few which are extremely fine that will be explained later, to make a kerf that is wide enough to allow the blade to follow through. This allows some clearance for sawdust and keeps the blade from being pinched by the fibres at the sides of the cut. The set should be wider for green wood because the fibres when cut, bend to some extent. When the teeth have passed through the cut, the fibres straighten out binding the blade, unless the kerf is wide enough to avoid difficulty.

The positions of the file in filing, the cross cut and the rip saw are shown in Fig. 3. This will make satisfactory cutting saws. View *A* shows the angle of the cross cut tooth, and view *B* the amount of fleam given. If 35 degrees is given in place of 45 degrees, the cut will be smoother. View *C* shows the degrees at which the file is held when moving it back and forth. View *D* shows the angle of the rip tooth, view *E*, the position of the file in a top view and *F* the position of the file looking from the end of the saw.

The saws used by the pattern maker are the cross cut, rip, back, dovetail, compass, key hole and coping. For general work a cross cut saw with 8 points to the inch and a rip saw of 4½ or 5 points to the inch make desirable tools. The back saws which include the regular back saw and dove tail are made of extra thin steel which is stiffened by metallic backs. The dove tail saw is a handy tool. It may be obtained 1½ inches wide under the back 26 gage and 17 points to the inch. This saw requiries no set. The regular back saw, about 12 inches long and 12 points to the inch, often is used in a mitre box for which it is best adapted. When used without the mitre box, care should be taken to start the cut vertical, since after the teeth have entered into the wood a short distance there is no way of altering the direction, as may be done by other hand saws. When starting a cut with the back saw, first place the heel of the blade on the edge of the work farthest away, and draw the blade toward the operator. The rip and cross cut saws are started by holding the knuckle of the thumb against the blade of the saw and the rest of the hand on the board. This steadies the saw, which then is given short strokes until a sufficient depth is reached.

It is not a difficult operation to file a saw, but it takes good eye sight and some practice. Jointing the saw is the first operation. With a flat mill file, the points of the teeth are filed down until all are the same length. A top filing or jointing block is shown in Fig. 4. The teeth must be jointed square with the blade, otherwise the saw will run more or less. Some filers file the points so that a straight edge will bear on all teeth while others make a crown which is a circle with a large radius making the center ⅛ or ¼ inch higher than the ends. Rip saws are jointed straight although some prefer them as much hollow as the cross cut is crowned.

Setting the Saw

The next operation is to set the saw. Some filers set a saw and sharpen afterward, while others reverse the operations. Good results are obtained both ways. The hammer and anvil probably will give a more definite set, that is it will be more regular and even than a spring set. However, the spring set is used greatly and is extremely satisfactory. The spring set gives a circular bend, while the hammer and anvil bends the teeth over flat. With either one, the anvil part of the saw

set must not have a sharp edge where the saw bends, as the teeth may break, but rather should be rounding so the tooth will bend easily. The tooth should not be bent back further than ½ the length of the tooth, ¼ of the length would be better, as only the points need to project. Set the teeth alternately, right and left, though few do it that way. Usually one whole side is done, then the other side. Do not set the teeth any more than is necessary for the saw to clear the wood easily. Green lumber takes more set than dry because the fibres of the green lumber spring back against the saw if the kerf is not wide enough. After setting, the teeth are side filed with a mill file to even up the setting as it is difficult to set each tooth alike.

Is Important Operation

Setting is a most important operation, because a good saw is well tempered and will hold its edge, but being tempered it is more or less brittle and teeth may be broken off if not carefully handled. Two or three light blows are better than a heavy one when using the hammer and anvil set.

The saw is now placed in a rigid saw vise and is ready to be filed. A piece of leather may be placed between the saw blade and the vise to reduce the sound. A 6 or 7 point saw uses a 7-inch slim tapered file. An 8 or 9-point, uses a 6-inch, and a 10, 11 and 12-point saw uses a 5-inch slim tapered file. There is a difference of opinion among filers as to the advisability of filing from the heel to the point or the point to the heel. The writer has filed saws both ways with equally good results. The way one may do it in the best and quickest manner have a saw cut in the same way seems to be the correct method. Those who object to filing from heel to point say it makes a feather edge at the point, but this will be removed in several strokes of the saw. Those who object filing from point to heel, point out that one must file the teeth that are bent towards the saw filer and the saw chatters making it impossible to file even and sometimes resulting in broken teeth. However this will not be the case if one uses care.

With cross cut saws, a bevel or fleam always must be made across the front of the tooth. When through with one entire side, the saw and file are reversed as before. When filing rip saws, use a 7-inch slim tapered file and the set is used as in cross cut saws. If hard lumber is to be sawed, a slight fleam is advisable, but in soft wood, file it straight across. A saw filing guide may be obtained which directs the file so that all the teeth are filed at the same angle.

The compass saw ranges from 10 to 20 inches long and is used for cutting curves and sweeps. The key hole saw is smaller than the compass and is used for smaller radii. This saw may be obtained with three different size blades with a loose handle which holds the blades with a set screw. The coping saw is one with a very narrow blade of about ⅛ inch wide or less. It has a frame similar to a back saw and the blade is adjustable in different directions, that is, the teeth can be pointed outwards or either right or left.

It is true that the band and circle saws in a pattern shop have almost eliminated the use of the hand cross cut and rip saws, yet at the same time, the terms and fundamental principles of tooth forms are the same in both hand and machine driven saws.

Refining Metals Electrically

(*Concluded from Page* 700)

In pouring steel castings, a fair sized stream always should be used, the smaller castings being poured first when the metal is hottest, tapering off to larger and heavier pieces toward the end of the pour. Good practice the writer has found to be to pour mostly light work on one heat, and follow with another for the heavier castings. On the hot heats a 1½-inch opening is used, while for the large castings where cold metal is used either a 2 or a 2½-inch brick is used, depending upon the size of the heat, and the number of stops to be made. In opening and closing the stream considerable practice is required. The opening and closing should be positive, the rod being closed with a quick snap of the wrist which throws the stopper into place, and forces any accumulation of metal from the face of the nozzle brick.

With the trouble often arising from bottom pour ladles causing them to be poured over the lip, it is mandatory that a good system of ladle gearing should be adopted, which will allow the ladle to be tilted easily, and accurately if desired. A good arrangement is that of a helical worm gear, which operates easily in a positive manner, and is self-locking. The tilting arrangement together with the mechanism operating the rod always should be kept well cleaned and thoroughly greased so that every movement is quick and easy with no possible chance of binding.

With the many excellent ladles placed on the market by the various manufacturers it is not worth while to build one. The different manufacturers have profited by experience in the design of their ladles, the rod operating mechanisms, and the tilting gears, and their product is such that it is hard to improve upon. Home made equipment usually is costly in the end, and the modern and progressive foundry should not be quick to adopt their own design especially if differing radically from a standard equipment. In the purchase of ladles for foundry use, it will be preferable to obtain those which are short and wide, rather than the higher and more narrow, due to having less head of metal to force the flow into the mold, the easier and softer the stream the better the casting.

Cleaning Costs Added

Much trouble and cost is caused the cleaning room by careless pouring of steel castings. Scabbing is caused by pouring metal either too hot or too fast into a certain casting; the same cause often gives rise to heavy fins, the force of the heavy stream actually lifting the cope from the drag. Shrink holes are caused by improper heading or by lack of feeding, often resulting in a lost casting due to the lack of a little thought. Large castings where the shrinkage is heavy should be poured slowly until the metal is into the head, when the ladle should be moved over the head and this filled with fresh metal. This places the hot metal where needed, in the point of latest solidification, and where it will perform its required duty of feeding the body of the casting. If necessary several additions of hot metal should be made to this head, when it can be covered carefully with a small amount of charcoal and allowed to set. A shrink hole never should be found on a properly handled casting, and such a defect is rarely the fault of the metal.

Harry W. Grigsby, who has been affiliated with E. J. Lavino & Co., Philadelphia, has been placed in charge of Chicago office at 208 South LaSalle street. In 1915-16 Mr. Grigsby was connected with Cranberry Furnace Co., Johnson City, Tenn., and from 1916 to 1918 was secretary and treasurer of Oriskany Ore & Iron Co., Lynchburg, Va. When Oriskany company was taken over by Lavino interests Mr. Grigsby was employed at its Philadelphia office and later at the Pittsburgh office.

Milestones in Foundry Progress

As Recorded in the September Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

WITH the September issue of 1895, THE FOUNDRY entered on its fourth year. Despite the period of general business depression which marked its infant years, it had grown in size and prestige and as its editor saw the future through his prophetic spectacles it was destined to maintain "the steady march of improvement."

* * *

The greedy grasping inclination to cut everybody's price regardless of consequences never helped to make molders as a class of mechanics better, just the opposite has been the effect.
KRANK'S KORNER

* * *

Rensselaer Mfg. Co., Troy, N. Y., had completed some 60-inch valves for the water supply system of Alleghany, Pa. These valves which were the largest make up to that time were illustrated in the September issue, 1895.

* * *

RUTHLESS RHYMES

Dominic Cagliastro, a diminutive wop,
Into the valve mold dropped his wet mop.
The fire chief remarked as the last embers hissed,
"This foundry's employes are bound to be missed."

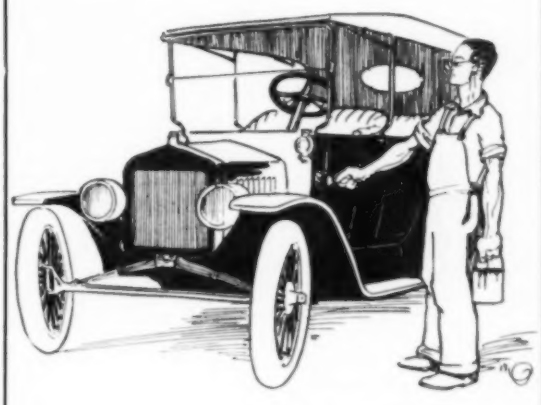
* * *

P. D. Warner, Reading Foundry Co., Reading, Pa., presided at a meeting of the Philadelphia Foundrymen's association. Cast iron pipe business was reported so slow that it was recommended that foundries would profit by selling the iron in their yard rather than to run it into pipe at the prevailing prices.

* * *

James Chalmers, the tramp molder worked his way northward, encountered a yellow fever scare at Memphis which finally drove him up the river to Cincinnati. Wages were $2.00 a day around Cincinnati and Hamilton in those days.

Faked Foundry Facts



Touch Her Up

N. N. Hill's Brass Foundry, East Hampton, Conn. was nearing completion.

* * *

No. 2 pig iron was selling at $12.75 to $13 a ton, Northern and Southern grades being practically the same price.

* * *

ALBERT SAUVEUR presented an interesting article on metallography applied to foundry practice in the September, 1905 issue of THE FOUNDRY. Typical apparatus of that day was shown.

* * *

W. H. Fonda remarked that he preferred test bar results over analysis to determine the comparative quality of iron used.

* * *

Tod Gibler, an old time foundryman, who heard of the beneficial results of test bar comparisons told his foreman to run off a ton or so of them for stock the next time they had a particularly fine heat.

A. V.

* * *

No. 2 foundry iron was selling at $12 a ton, Birmingham and $14.50, Chicago furnace.

* * *

W. J. Keep's sectional cupola was described and illustrated. The stack was hung from the roof girders, the central section was built up and rested on a truck which supported the tuyeres and hearth.

* * *

Practical Alloying, by John F. Buchanan was running serially in THE FOUNDRY.

* * *

John C. Burns in a paper which was prepared for the American Foundrymen's association stated that the foundryman was becoming less of a journeyman, though no less a mechanic and he predicted that the foundry of the future would be a specialty shop.

* * *

George Pickup resigned a position with the Adams Co., Dubuque to become manager of the Wehrle Stove Works, Newark, O.

* * *

Congratulations, on your twentieth anniversary, George.

EXTENSIVE plans for the annual convention of the American Foundrymen's association to be held at Atlantic City, Sept. 27 to Oct. 1 were announced. R. A. Bull was president of the American Foundrymen's association and G. H. Clamer, later president of the Foundrymen's association was president of the American Institute of Metals.

* * *

Ankle length bathing suits, with sailor collars and long sleeves were the vogue for ladies. They also wore straw hats and what looked to be gum boots. No water could touch them.

* * *

G. S. Evans described the manufacture of car wheels at the Lenoir Car Works, Lenoir City, Tenn.

* * *

Tunnel segments were being made for the East River tunnel in New York, by the Wheeling Mold & Foundry Co., Wheeling, W. Va. The process was described by Louis J. Josten.

The Shakeout

DAN M. AVEY, Managing Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ Line Between Can And Can't

UNTIL a short time ago, the attitude of the government toward trade associations and other commercial groups was beclouded. No definite procedure was suggested by which such an organization could serve its members and avoid a more or less violent collision with the Sherman anti-trust act. In fact, the obscurity which existed regarding the rights of such associations offered at least a pleasing prospect for personal advancement should any of the government prosecutors stand in need of a case to bring their own abilities to the attention of those they served.

THE chamber of commerce of the United States has issued a bulletin describing a decision of the Supreme Court, handed down June 1, 1925, holding that statistical activities of trade associations are lawful. This permits organizations to render their members service by gathering and reporting statistics relating to producing capacity, orders, shipments, stocks and markets as shown by closed transactions. The department of commerce suggests that in renewing statistical activities, methods and forms should be simplified so that these may be classified and transmitted as promptly as possible. One of the most important requirements of figures of this nature is that they shall be fresh as well as dependable. With apprehension removed, much really valuable information for the good of industry should be brought to light.

¶ Play Time Slows The Wheels

NOW that the vacation season practically has closed, various industries are expecting considerable improvement in business conditions. During recent years a lull has appeared during the summer months, which some claim is caused by the growing tendency of those in the office to do as little work as possible during the hot months. This condition may be blamed on vacations, including the period of anticipation before and the time for recuperation after the return, or on golf, baseball, fishing, motoring, or many other seemingly innocent recreational measures, but nevertheless it exists and is having an effect on the business condition of the country.

Other factors gradually are limiting the time for business activity. Only a few years ago plants were open six full days a week, and the salesman considered Saturday as good a day as any other for making calls. Then somebody started the half holiday on Saturday afternoon, others followed until now closing Saturday noon is practiced almost universally. The salesman soon found that it was impossible to obtain an audience on Saturday morning thus cutting the period of his activity to five days. How far will the tendency carry us?

¶ Freight Flies High

BITS of news gathered from throughout the world proclaim the passing of the era of experimentation in aerial transportation and the establishment of lines for the fast dispatch of passengers and freight on a successful commercial basis. Aside from the air mail service, which has pioneered the development of commercial flying, perhaps the greatest incentive and publicity given toward the development of the airplane as a freight carrier in recent months has been through the establishment of daily freight service by the Ford Motor Co., with routes from Detroit to Chicago and Cleveland and a cargo varying from small packages to a complete automobile. That company also recently purchased a plant manufacturing airplanes, and will limit the output to several models of an all metal commercial plane.

NEW applications of this method of fast transportation are appearing daily. The rapidity with which the styles of women's clothes change has opened another avenue for the air freight business. Wearing apparel manufactured in New York during the day is loaded in airplanes for Chicago and Cleveland in the evening, and in the morning milady is shown the latest fashions. A saving of six months in the time of delivery and the elimination of expensive pack trains is the motive behind the proposal to ship 117,000 pounds of iron pipe and fittings by airplane from Iron Mountain, Mont., to a point in Idaho. A company now is being formed to establish a dirigible passenger line between New York and Chicago, with the view to opening service between other cities if the first venture is successful.

SUFFICIENT capital and public interest have been the crying needs for the successful development of air transportation. Both are growing rapidly, for this country, the birthplace of the airplane, at last has awakened to the possibilities of aerial transportation and communication. The time is not far distant when foundrymen will find a splendid business opportunity through the manufacture of parts for airplanes and dirigibles.

Trade Outlook in the Foundry Industry

DECIDEDLY more favorable prospects are noted among foundries with the approach of the fall season. While the tendency to buy in small lots and to order only for immediate requirements continues, the volume of business transacted continues to grow. Foundries in New York state and among some of the New England states report increasing business. The rate of operation in these sections ranges from 75 to 80 per cent of capacity. In Ohio, according to A. J. Tuscany, secretary of the Ohio State Foundrymen's association, July showed operations at 85.3 per cent compared with 73 per cent for the preceding month.

Pipe Shops Busy

One of the most active factors in present foundry activity is the continued buying of cast iron pipe. Although orders in general are not large, the aggregate is sufficient to sustain capacity operation with sufficient business booked to insure continued activity for the next 60 days. In fact delivery of cast-iron pipe cannot be promised under two months at the present time. The heavy demand for cast-iron pipe indicates that the building program of the past few years has developed communities ahead of their water, gas and other utility requirements. Further, smaller communities are extending their street lighting facilities and making other municipal improvements that carry with them large casting requirements. Advances are noted in sales of electrical appliances of all classes. The Westinghouse Electric & Mfg. Co. received orders for the quarter ending June 30 which totaled $44,432,200, giving an increase of more than 11 per cent when compared with the same period last year. Steel production continues at a high rate. Textile mills are increasing operations. While sales of mail order houses have declined slightly, this is attributed to the regular seasonal slack.

Prices for Raw Materials for Foundry Use

CORRECTED TO AUGUST 22

Iron		Scrap	
No. 2 foundry, Valley	$18.50	Heavy melting steel, Valley	$19.00 to 19.25
No. 2 southern, Birmingham	18.00 to 18.50	Heavy melting steel, Pitts.	19.00 to 19.50
No. 2 foundry, Chicago	20.50	Heavy melting steel, Chicago	16.25 to 16.75
No. 2 foundry, Philadelphia	21.26	Stove plate, Chicago	17.25 to 17.75
No. 2 foundry, Buffalo	19.00	No. 1 cast, Chicago	20.25 to 20.75
Basic, Valley	18.00 to 18.50	No. 1 cast, Philadelphia	17.50 to 18.25
Basic, Buffalo	18.50 to 19.00	No. 1 cast, Birmingham	15.00 to 16.00
Malleable, Chicago	20.50	No. 1 cast, Buffalo	17.00 to 17.50
Malleable, Buffalo	19.00	Car wheels, iron, Pittsburgh	17.00 to 17.50
		Car wheels, iron, Chicago	17.50 to 18.00
		Railroad malleable, Chicago	19.50 to 20.00
		Agricultural, mal., Chicago	17.75 to 18.25
		Malleable, Buffalo	18.00 to 18.50
Coke			
Connellsville foundry, coke	$3.25 to 4.25		
Wise County foundry, coke	4.50 to 5.25		

Farm Future Bright

Favorable outlook for fall business is presaged by the improved conditions in farm localities. The farmer is better able to buy all classes of commodities this fall than at any time since the war. Sales of farm implements are picking up, starting with the greatly intensified demand for harvesting machinery and extending through all classes of power equipment. Tractor manufacturers are behind on their orders, while truck sales undoubtedly have been supported by the farmer's requirements. Increased prices for farm products also have strengthened the demand for secondary equipment of all classes. Improvements are being made in homes, through the purchase of domestic machinery, pumping plants, heating and sanitary ware and lighting installations. Further, the sale of automobiles in the rural districts has been phenomenal and probably will continue as the farmer's inclination for the closed model car with the advance of winter, may be gratified, due to the high prices of farm products and the exceptionally fine crop conditions.

Autos Hold Pace

July production of all classes of automobiles stood at 397,094 compared with 402,848 for the preceding month, according to the department of commerce. Truck output showed an increase over the preceding month. The total for the first seven months of the year is well in advance of the same period last year. July showed a total of only 270,935 passenger cars and trucks in 1924. The same month this year showed an increase of 126,159 cars over last year. Automobile foundries are busy, although orders continue on the hand-to-mouth basis as before. Freight shipments continue at a high level, but orders for railway equipment are light. The prospects for plumbing business with its indirect influence upon the demand for castings are bright, according to the National Trade Extension bureau of the plumbing and heating industries. Both new building and renovation business is expected to improve. Steel castings orders increased in July, according to the department of commerce. The bookings of commercial steel castings during that month were 54.2 per cent of capacity, while the railway specialty orders were 46.4 per cent of capacity. During the preceding month, the bookings of commercial work were 48.2 per cent and railway orders were 38.8 per cent, while July 1924, was much below even these figures with 38 per cent in commercial and 37.8 per cent in railway steel bookings.

Nonferrous Operations

Brass foundries, in general, are busy, with the greater volume of business going into plumbing goods and automotive lines. Aluminum foundries especially those making castings for sweepers and other domestic sundries are busy. New York prices on nonferrous metals, according to the *Daily Metal Trade* of Aug. 22, follow: Casting copper, 14.20c; electrolytic copper, 14.85c; Straits tin, 58.12½c; lead, 10.12½c to 10.25c; antimony, 17.00c; nickel, 38.00c; aluminum, No. 12 remelt, 23.00c. Zinc is 7.65c to 7.70c, E. St. Louis, Ill.

Comings and Goings of Foundrymen

ALTON V. PITTS, who for the past seven years has been general superintendent of the Kent Machine Co., Kent, O., has organized the Pitts Foundry Co., Inc., Birmingham, Ala. The officers of the new company are Alton V. Pitts, president and treasurer; G. Johnson, vice president and superintendent, formerly with the Miller Improved Gas Engine Co., Springfield, O.; A. Wynn Jones, secretary. The company has leased and is operating the foundry and pattern shop formerly occupied by the American Blakeslee Mfg. Co. which has a capacity of 20 tons per day of gray iron castings.

E. A. Spring, manager of the Globe Foundry & Machine Co., Globe, Ariz., for the past four years, has resigned to head the Capital Foundry Co., Phoenix, Ariz., which recently started operations.

Arthur Deeley formerly with Nichols & Shephard Co., Battle Creek, Mich., has become foundry superintendent of Western Gas Construction Co., Fort Wayne, Ind.

J. E. Olson, formerly in charge of the Bessemer Gas Engine Co., Grove City, Pa., has resigned his position to accept a similar one with the Bethlehem Steel Corp., Elizabeth, N. J.

Donald S. Jones has been made general manager of the Dennison Alloy & Steel Casting Co., Dennison, O. Mr. Jones was formerly industrial engineer with the Forest Products Engineering Co., Chicago. Mr. Jones has had 12 years foundry, machine-shop and industrial engineering experience. Prior to his connection with the Forest Products Engineering Co. he was in charge of the roll shop for Mackintosh-Hemphill Co., Midland, Pa.

Grant Morrison has purchased controlling interest in Bay City Iron Co., Bay City, Mich., and is now president. He formerly was treasurer and manager. Other officers are: James E. Morrison, vice president, and Carrie Morrison, secretary.

Leon Guillet has been elected a member of the French Academy of Science in the section of application of science to industry. Mr. Guillett is well known for his research work in metallurgy and more especially on the constitution of alloys and on metallography. He is past president of the French society of civil engineers and is the director of the Ecole Centrale des Arts et Manufactures, one of the leading French engineering schools. Mr. Guillet is a doctor of science and member of many French and foreign scientific associations.

Charles Michael, president, Ohio Locomotive Crane Co., Bucyrus, O., has purchased the Bucyrus plant of Ohio Steel Foundry Co., Lima, O. The plant will be remodeled and in three months will operate as a gray iron foundry. The plant has been idle since 1920.

Lay Ground Work for Local Entertainment

Extensive plans are being made by local committees at Syracuse, N. Y. to handle the forthcoming convetnion of the American Foundrymen's association to be held in that city Oct. 5 to 9. A committee has been formed of representatives of the leading foundry and manufacturing interests of northern New York. These men are interested in assuring the comfort and entertainment of visiting foundrymen this fall. The general committee having charge of this work has been designated as follows:

General Committee

W. L. Hinds, chairman, Crouse Hinds Company, Syracuse, N. Y.
W. W. Cheney Jr., vice chairman, S. Cheney & Son, Manlius, N. Y.
Harold B. Coyne, secretary, Reddin Iron Works, Syracuse, N. Y.
R. E. Boschert, Dunning & Boschert Press Co., Syracuse, N. Y.
E. O. Buesing, McIntosh & Seymour Co., Auburn, N. Y.
W. W. Cheney Sr., S. Cheney & Son, Manlius, N. Y.
F. G. Chambers, Straight Line Engine Co., Syracuse, N. Y.
H. H. Elmer, Globe Malleable Iron Works, Syracuse, N. Y.
Fred Frazer, Frazer & Jones, Syracuse, N. Y.
G. D. Green, Empire Foundry Company, Syracuse, N. Y.
Martin W. Henley, Frazer & Jones, Syracuse, N. Y.
E. A. Hurdman, E. C. Stearns & Co., Syracuse, N. Y.
B. F. Lemke, Bausch & Lomb Optical Co., Rochester, N. Y.
J. L. Lonergan, Morris Machine Company, Baldwinsville, N. Y.
H. E. Longwell, Pierce, Butler & Pierce, Syracuse, N. Y.
W. F. McCann, Utica Steam Engine & Boiler Works, Utica, N. Y.
W. F. Merrill, Lamson Company, Syracuse, N. Y.
J. R. Montague, Engelberg-Huller Co., Syracuse, N. Y.
G. A. Newman, Syracuse Chilled Plow Co., Syracuse, N. Y.
David C. Park, Smith & Caffrey, Syracuse, N. Y.
Wm. Blackwood Smith, Smith & Caffrey, Syracuse, N. Y.
E. C. Stearns, E. C. Stearns & Co., Syracuse, N. Y.
W. H. Thomas, Straight Line Engine Co., Syracuse, N. Y.
W. W. Wiard, Syracuse Chilled Plow Co., Syracuse, N. Y.
L. P. Willsea, Willsea Works, Rochester, N. Y.

The chairmen of the various operating committees have been designated as follows:

Finance: A. Hurdman, E. C. Stearns & Co.
Publicity: W. W. Wiard, Syracuse Chilled Plow Co.
Entertainment: J. L. Lonergan, Morris Machine Co.
Ladies' Entertainment: William Blackwood Smith, Smith & Caffrey.
Plant Visitation: H. E. Longwell, Pierce, Butler & Pierce.
Golf: Martin W. Henley, Frazer & Jones.
Hotel: David C. Park, Smith & Caffrey.
Transportation: G. A. Newman, Syracuse Chilled Plow Co.

Welders Hold Exhibit

The American Welding society will hold its fall meeting at Massachusetts Institute of Technology, Cambridge, Mass., from Oct. 21 to 23. An exposition will be held in conjunction with the meeting. The program of this meeting is as follows:

Exhibitions and Demonstrations

Wednesday, Thursday and Friday, 9 a. m. to 5 p. m., and Wednesday evening, 7:30 p. m.

Technical Sessions

Wednesday morning, Oct. 21, 10 a. m. to 12 m. "Thermit Welding," J. H. Deppeler, chief engineer, Metal and Thermit Corp.

Wednesday afternoon, Oct. 21, 2 p. m. to 4 p. m. "Gas Welding of Power Plant Piping." Author to be announced later.

Thursday morning, Oct. 22, 10 a. m. "Industrial Applications of Arc Welding and Economies Effected Through Its Use." Joint paper by H. M. Hobart, chairman, electric arc welding committee, and W. Spraragen, secretary.

Friday morning, Oct. 23, 10 a. m. to 12 m. "Selection of Materials for Welding." A series of short addresses by several authors.

Friday afternoon, Oct. 23, 2 p. m. to 4 p. m. "Spot Welding of Automobile Bodies," J. W. Meadowcroft, general supervisor of welding, E. G. Budd Mfg. Co.

Research and Business Session

A meeting of the research department of the society, American Bureau of Welding, will be held Thursday afternoon, Oct. 22, 2 p. m. to 4 p. m. Program will include review of present activities and outline of future investigations.

A board of directors meeting will be held following the research meeting at 4 p. m.

For convenience of members and guests, lunch will be served at cost at the cafeteria of Massachusetts institute. On Thursday evening, Oct. 22, a dinner and theater party has been arranged. Sight-seeing busses will be provided to enable the ladies to visit all points of interest.

Electrochemists Plan To Hold Fall Session

American Electrochemical Society will hold its annual fall meeting at Chattanooga, Tenn., Sept. 24-26. A number of important papers will be presented by well-known authorities on electrochemical subjects.

The first two days of the meeting

will be taken up with the technical program. The subject of the symposium for this meeting will be, "The Relation of Electrochemistry to The Fertilizer Industry." Dr. H. C. Parmelee will be in charge of the symposium. Nitrates, phosphates, hydrogen, potash and other subjects will be the topics under discussion. On Friday a roundtable discussion will be conducted on "Electric Ferroalloys." Robert Trumbull will be chairman.

On Saturday, Sept. 26th, members and guests will spend the entire day at Muscle Shoals. This will afford an unusually fine opportunity to inspect America's largest dam, an important development to the electrochemical industry. Paul J. Kruesi, chairman of the local committee, has arranged a further program of visits to other places of interest.

A Correction

Through error, the business connection of W. J. Corbett, author of the article "Reviews Factors Affecting Costs of Steel Castings" was omitted from the presentation on page 640 of the Aug. 15 issue. At the time this article was written Mr. Corbett was connected with the Electric Steel Founder's Research Group and the material was prepared for presentation at a meeting of the American Iron and Steel institute. The author at present is secretary of the Steel Founder's Society of America, Pittsburgh.

Josiah Thompson Dies in Philadelphia

Josiah Thompson, one of the founders of the Philadelphia Foundrymen's association in 1891 and its treasurer for 30 years, died in that city on July 14 at the advanced age of 80 years. With the exception of the late Thomas Devlin who died recently after rounding out 63 years in the foundry, Mr. Thompson was the oldest man connected with the foundry industry in eastern Pennsylvania. He started in the foundry business with a firm that long has been out of existence and in 1889 joined I. S. Cassin to form the firm of I. S. Cassin & Co. A few years later he bought out Cassin's interest and established the firm of J. Thompson & Co., which employed about 50 men. In 1875 he was connected with a firm engaged in the manufacture of pumps, valves, hydrants, and general municipal street castings and supplied many castings for the Centennial exhibition held in Philadelphia 1876. With slight variation he has followed the same line of casting manufacture since that time.

Death of Mr. Thompson leaves a notable gap in the ranks of veterans who on July 19, 1891, met for the first time as the Philadelphia Foundrymen's association. This organization enjoys the distinction of being the second oldest of its kind in the United States and the oldest in point of actual continued existence. Its predecessor, the Western Foundrymen's association, passed out of existence many years ago after a comparatively short life. At the first meeting Francis Schumann was elected president, Thomas Devlin treasurer and Howard Evans, secretary. Mr. Evans has been all these years and still is secretary of the association. Early in 1896 the Philadelphia organization conceived the idea of starting a national foundry association and as a result of its efforts a convention of foundrymen was held in the city on May 12, 13 and 14 of that year and the American Foundrymen's association was formed with Francis Schumann as its first president.

JOSIAH THOMPSON

Nathan C. Harrison, treasurer of the Harrison Supply Co. Inc., 5 Dorchester avenue extension, Boston, sailed for Europe on the BENENGARIA, Aug. 26. The Harrison Supply Co., imports abrasive materials and supplies and Mr. Harrison is going abroad for the twenty-fifth time to survey the business situation in the abrasive field in Europe.

Bill Gives Advice on a Plunger Casting

(*Concluded from Page* 704)

an investment and therefore he might not care to make a change. However, in case he was interested I directed his attention to an article which was published in THE FOUNDRY on page 15, January 1920 describing the method and rigging employed successfully in making cotton packing cylinders 8 feet in length and 30 inches in diameter.

"Bill" I said. "That is all quite interesting, but have you ever heard the story of the county inspector who was putting the little country school through its paces?"

"I'll bite." said Bill. "I have heard many country school stories, but you probably will get this one all mixed up and its an even chance that by the time you are through I will not recognize it."

"This inspector" I said, calmly ignoring Bill's flippant and totally unwarranted comment "put question after question to the neatly polished little boys and girls and in his best county inspector style expressed himself as delighted each time with the result. Then he unbent ponderously and jocosely and asked if any little boy or girl present would like to ask him a question.

"With one hand under his coat tail and the other toying with his massive gold watch chain he beamed benevolently over his eye glasses. After a hushed and awe stricken pause he was rewarded by the sight of a little timid hand raised above one of the back benches.

"Yes, my boy" said he with his professionally indulgent smile. "What is it you would like to know?"

"Please sir" said the tired little boy in the back seat "what time does your train leave?"

Amos Whitely Dies

Amos Nelson Whiteley, retired manufacturer, died at his home in Muncie, Ind., Aug. 3, aged 86 years. For 30 years previous to 1919, Mr. Whiteley was head of the Whiteley Malleable Castings Co. and its subsidiary, the Whiteley Steel Casting Co. In that year he sold his interest to the Muncie Malleable Castings Co. He was a brother of William N. Whiteley, Springfield, O., known as the "reaper king," and was associated with the latter first at Springfield and later at Muncie. But the shops at Muncie erected by the brothers burned in 1894 and never were rebuilt.

Equipment Sales Gain Slowly

August Total Slightly Better Than in July, but Greatly in Excess of Volume of Business in August, 1924— New Construction Increasing

SLIGHT gains are recorded in equipment buying in August over July, while in many cases the volume of sales in the month just past has marched far ahead of the business closed during the corresponding month a year ago. The rate of improvement has been stepping up gradually since June, when the lull period started. Manufacturers generally are exceedingly optimistic over the prospects for the remainder of the year. This feeling of confidence for future betterment is augmented by the fact that inquiries are appearing at a heavy rate, many of which are considered exceptionally live prospects for an early closing.

Demand for molding machines, sand mixers and cleaning equipment continues. The construction of a number of new plants throughout the country is reported, among which is included a new pipe shop to be erected by the American Cast Iron Pipe Co., Birmingham, Ala., to manufacture sand-spun, centrifugal, cast-iron pipe. Manufacturers are preparing their displays for the exhibition of the American Foundrymen's association which will be held in Syracuse, N. Y., next month, and expect to dispose of considerable equipment in connection with this show.

Inquiry Rate Signals Improvement

SELLERS of equipment in the Pittsburgh district are in the midst of a dull period. Orders of a replacement character continue light which merely is a continuation of the condition that has maintained for the past few weeks. While slack operations exist at some foundries in this territory, the trade anticipates the resumption of activity by fall. A lull in buying of cupolas, ladles and tumblers is noticed although some inquiry is in the hands of district representatives of builders, which hold promise of becoming active next month. Little new construction is under way at present. The bright spot in the market is found in the number of inquiries for molding machines. August usually is a quiet month but the amount of requests seeking prices on molding machines is heavy. Within the past two weeks sales of this type of equipment have included one for the Chapman Valve Mfg. Co., Indian Orchard, Mass.; one for the National Brake & Electric Co., Milwaukee; three for the Hughes Tool Co., Houston, Tex.; one for the Pennsylvania Railroad Co., Altoona shops; two for the American Radiator Co., Buffalo; four for the Massillon Steel Casting Co., Massillon, O.; one for the Bonney-Floyd Co., Columbus, O., and one for the Lockhart Foundry Co., Newark, N. J., the orders going to the Herman Pneumatic Molding Machine Co., Zelienople, Pa. The Westinghouse Electric & Mfg. Co., Philadelphia, has purchased sandblast equipment from the Pangborn Corp., Hagerstown, Md., and the Richmond Radiator Co., Uniontown, Pa., has secured vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Cleveland Market Steady

SALES of foundry equipment in the Cleveland territory continue at about the same rate as reported two weeks ago, the movement of material being satisfactory for this period of the year, which usually is marked by a falling off in business. Inquiries continue to be brought out in good number, many of which are considered excellent prospects for future sales. On the whole, men of the trade feel that a substantial improvement in the market is just around the corner, and that a steadily increasing volume of sales will be realized during the remainder of the year. The United States Radiator Corp., Detroit, has purchased shakeout bails from the Stoney Foundry Engineering & Equipment Co., Cleveland, while the Ferro Foundry & Machine Co., Cleveland, and the Holmes Foundry Co., Port Huron, Mich., have ordered vibrator and shakeout equipment from the same manufacturer, the latter company also taking equipment for its subsidiary at Sarnia, Ont. A complete sandblast room with dust arrester equipment has been bought by the National Sanitary Co., Salem, O., and the Holmes Foundry Co., Port Huron, Mich., from the W. W. Sly Mfg. Co., Cleveland. That company also has sold a pressure sandblast and dust arrester equipment to the Hughes Tool Co., Houston, Tex., and tumbling mills to the Odin Stove Mfg. Co., Erie, Pa. The J. W. Pohlmann Foundry Co., Buffalo, and the Cleveland Co-Operative Stove Co., Cleveland, have purchased sandblast equipment from the Pangborn Corp., Hagerstown, Md.

Eastern Lull Continues

AN ENCOURAGING feature of the New York foundry equipment market is an improved demand for supplies. This is taken as an indication that the foundries are in receipt of somewhat better business and that a revival in the buying of heavy equipment may follow in the relatively near future. Some encouragement also is offered by the fact that more foundry building is under contemplation than in sometime. This does not mean that there is any large amount of work in prospect, or that some of the work has not been mentioned previously in trade circles; nevertheless, more work is under active consideration. Alloys & Products Inc., West Farms Road, New York, plans the erection of a foundry and office building. The Krupp Foundry Co., Landsdale, Pa., contemplates a new foundry at Quakertown, Pa. The Lacoming Foundry Co., Williamsport, Pa., has an addition under contemplation, and the Lenox Furnace Co., Eastwood, Pa., a foundry building. The A. P. Smith Mfg. Co., East Orange, N. J., has acquired the plant of the Simms Magneto Co. in that city, which will be used partially as an extension. However, it is understood that little new equipment

will be required. The Adirondacks Steel Foundries Corp., Watervliet, N. Y., is expected to close shortly on a 10-ton electric crane. Sellers of cupolas assert that August was one of the poorest months this year. Sand mixers moved somewhat better toward the end of the month than in several weeks. However, all in all, equipment buying in August was the lightest this year. Prices on cranes and conveying equipment continue among the weakest of the entire equipment list.

Chicago Sales Hold

AUGUST sales of foundry equipment in the Chicago district practically have held their own with July, but have shown decided improvement over last August. Heavy buying of pig iron and scrap by foundries, especially those on automobile and implement work, makes equipment manufacturers believe they are next in line. The National Engineering Co., Chicago, has sold sand mixers to the Haynes Stellite Co., Kokomo, Ind., and the Midvale Co., Philadelphia. The Naval Air Station, San Diego, Calif., has contracted for sand blast equipment from the Pangborn Corp., Hagerstown, Md., and the Remy Electric division of the General Motors Corp., Anderson, Ind., has ordered sandblast and dust arrester equipment from the same company, duplicating the order listed in the issue of Aug. 1. New construction is rather light.

New England Shows Betterment

ACTIVITY in foundry equipment in New England shows improvement. Leading dealers report sales in August far above the sales for the corresponding month a year ago. A Greenfield, Mass., foundry bought a cupola from the J. W. Paxton Co., Philadelphia. The Hendley Machine Co., Torrington, Conn., has secured sandblast equipment from the Pangborn Corp., Hagerstown, Md. Sand mixers and molding machines have been placed with scattered foundries. Among other recent buyers are included the Universal Winding Co., Providence, R. I., and the Plainville Casting Co., Plainville, Conn.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

S. M. Howes Co., Boston, manufacturer of stoves, is building a manufacturing and assembling plant at 509 Medford street.

A. W. Wheaton Brass Works, 110 Walnut street, Newark, N. J., will build a 1-story addition to its plant.

Joseph Reid Gas Engine Co., Oil City, Pa., manufacturer of gas and oil well equipment, is building a 1-story addition.

George H. Lincoln Co., 191 Old Colony avenue, Boston, will build a 1-story foundry building.

Alloy Products Co., 1448 West Farms road, New York, is building an office and foundry one story, 96 x 162.

Stearns-Roger Mfg. Co., Denver, Colo., has bought the business of the Queen City Foundry Co. and will continue the business.

Dedman Foundry & Machine Co., Houston, Tex., is erecting a 1-story steel shop building 50 x 100 feet as an addition to its plant.

Reading Foundry & Supply Co., Reading, Pa., opened a branch at Pottstown, Pa., with Richard E. Smale as manager.

Buffalo Sash Weight & Foundry Co., 395 Fillmore avenue, Buffalo, contemplates expansion on North Division street.

Ajax Metal Co., Philadelphia, has awarded the contract for the erection of a building addition to cost $10,000, to M. Ward Easby, Inc.

Ohio Brass Co., Mansfield, O., C. K. King, general manager, will build a 2-story plant 55 x 55 feet. DeVore & Co., 908 Nicholas building, are architects.

Acme Smelting Co., 413 Second street, Chelsea, Mass., will build a 1-story foundry 50 x 100 feet—Scheine & Levine, 508 Pemberton building, are architects.

Diamond Bronze Co., 5415 Brow avenue, Cleveland, has awarded contracts for constructing 1-story, 60 x 125-foot plant on Sideway avenue.

Pacific Foundry Co., Eighteenth and Harrison streets, San Francisco, is building a 2-story pattern shop. A. J. Wilhelm, 180 Jessie street, has the general contract.

Holmes, Pyott & Co., 159 N. Jefferson street, Chicago, has purchased the southwest corner of Division and Kolmar streets as the site for a $150,000 plant.

American Pattern Foundry & Machine Co., 26 Forest avenue, Glen Ridge, N. J., has been organized by W. G. Whiteley and associates and will manufacture radio equipment.

Eureka Planter Co., Woodstock, Ont., is planning enlargement of its business and has bought the building formerly occupied by the Wayne Tank & Pump Co. which it will convert into a foundry.

Universal Casing Co., Inc., Los Angeles, has been incorporated with $100,000 capital by A. B. and N. C. Reiss, Dora and B. H. Lustig and M. G. C. Harris, with the last as attorney at 1102 Lincoln building.

The Camp Co., Walton, N. Y., has bought the plant of the Walton Foundry Co. and the latter will build a new plant 72 x 150 feet for the production of castings for creameries and municipal meter boxes.

Consolidated Castings Co., Cleveland, has been incorporated with $25,000 capital by Henry M. Schneider, Otto J. Zeman, Mark A. Copeland, Fletcher R. Andrews and O. E. Schultz.

Borough Foundry Co., Brooklyn, N. Y., has been incorporated with 2500 shares common stock no par value by J. E. Burns, T. E. Butler, and J. M. Hanley. Flanders, Harris & Barfoard, Albany, are attorneys.

Ajax Iron Works, Corry, Pa., has begun preparation of the site for its new warehouse structure on West Washington street. It will be equipped with modern devices for handling iron and steel materials.

F. N. DuBois Co. Inc., Newark, N. J., will build a foundry and other buildings, 1-story 40 x 50 feet, 50 x 100 feet and 90 x 160 feet. General contract to the Austin Co., 16112 Euclid avenue, East Cleveland, O.

J. B. Wine Co., Watertown, N. Y., was damaged by fire July 31 with heavy loss. The foundry and rolling mill suffered the heaviest loss. The company did a general machine shop and foundry business and manufactured plumber's supplies.

Burton Mfg. Co., 4554 Broadway, Chicago, manufacturer of electrical appliances will remove to Chicago Heights, Ill., its castings and machine work to be done by contract until a foundry and machine shop can be built and equipped.

American Cast Iron Pipe Co., Birmingham, Ala., will erect a new pipe shop at once, to be completed by Feb. 1 for the manufacture of sand spun centrifugal cast iron pipe, the new shop to have a capacity of 500 tons daily.

The Kwick-Mix Concrete Mixer Co., Port Washington, Wis., will build an addition to its plant to provide a gray iron foundry, supplanting the present melting shop at Fredonia, Wis. The cost will be about $20,000.

Louisville Brass & Steel Foundry Corp., Louisville, O., has been incorporated with $10,000 capital to build and operate a foundry by C. Jackson, Edgar G. Lindberg, Russell G. Burt, James E. Kinnison and Earl F. Shadrach.

South Side Malleable Casting Co., Fourteenth and Windlake avenues, Milwaukee, has placed a contract for the building of a foundry addition 177 x 186 feet with the W. W. Oeflein Co., 86 Michigan street. The improvement will cost about $150,000.

The machine and molding shops of the Windsor Foundry & Machine Co., Windsor, Ont., were damaged by fire with loss estimated at $50,000. It is expected that owners will rebuild without delay, and will require considerable tools and machinery.

The A. P. Smith Mfg. Co., East Orange, N. J., manufacturer of hydrants and valves and other casting specialties, has purchased the plant of the Simms Magneto Co., Arlington avenue. The plant is of reinforced concrete construction and contains about 211,000 square feet of floor space.

Weir, Frog & Switch Co., Norwood, O., has consolidated with Kilby Frog & Switch Co., Birmingham, Ala., according to J. K. Lansdowne vice president of Weir company. Manufacturing methods used at the Weir plant will be installed at the Kilby plant. Edward Schubert, mechanical engineer at the

Norwood plant, will go to Birmingham to install the new system. Both companies are large manufacturers of railroad, logging and coal mining machinery.

Walworth Mfg. Co., Boston, a large manufacturer of pipe fittings and wrenches, is negotiating for the purchase of Kelley & Jones Co., Pittsburgh, manufacturer and jobber of pipe fittings and plumbing supplies, according to a statement of Howard Coonley, president, Walworth Mfg. Co.

Walworth Alabama Co. has incorporated at Gadsden, Ala., with capital of $725,000, the announcement being made that the new company will carry out plans for enlarging the works of the National Pipe & Foundry Co. at Attalla, near Gadsden, recently purchased by the Walworth Co. of Boston.

American Car & Foundry Co., Harrisburg, Pa., will start construction immediately at Berwick, Pa., of additions and will install new equipment. An office building 50 x 124 feet, pattern shop and storage, three stories 120 x 180 feet and another 3-story building 60 x 125 feet will be erected. W. S. Johnson is district manager.

Tips & Smith, Houston, Tex., with capital of $20,000 have been chartered by J. C. Tips, Jr. and J. L. Smith, Jr. to manufacture aeroplane motors. Main shop buildings at 2911 Rusk street will be enlarged to include a pattern and tool shop. The company buys up old motors and converts them into the radial type engine by a special process.

Dennison Alloy & Steel Castings Co., Dennison, O., has purchased the patent rights, patterns, molds, finished and unfinished products of the bankrupt Martin Shovel Co., Greensburg, Pa. The company was engaged in the manufacture of shovels with gasoline tractors. Offices were maintained at Greensburg. Manufacturing is to be done in Dennison. W. T. McNut is president.

Reconstruction of the damaged portions of the Lakeside Malleable Castings Co., Racine, Wis., on a larger scale than before the recent fire, has been announced by W. H. Osborne, president and general manager. The main work is to replace the annealing buildings, and plans incorporate in this also the shipping department, calling for a structure, 85 x 300 feet, 1-story, fireproof. Work will begin at once, the general contract having been let to Nelson & Co., Racine. It will be ready early in the fall and enable the Lakeside company to handle a materially increased volume of business. (Noted Aug. 1.)

New Trade Publications

WEIGHING SCALES—A pamphlet describing and illustrating various styles and types of scales has been issued by Toledo Scale Co., Toledo, O.

CRANES—Part of the extensive line of equipment manufactured by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., is depicted in a four-page bulletin now being distributed.

PRODUCTION GRINDER—An 18-inch grinder for production work is featured in a bulletin by the Hisey-Wolf Machine Co., Cincinnati, O., with illustration and full specifications.

GLOVES—The line of steel sewed gloves, mittens, hand pads, leggings aprons, arm protectors, etc., as manufactured by the Industrial Gloves Corp., Chicago, is shown in a 24-page booklet. The description of each commodity is accompanied by an illustration.

GRINDING WHEELS—General information about grinding wheels, the materials from which they are made, method of manufacture, dressing, mounting in grinding machines and many other points make up a pocket-size booklet by the Norton Co., Worcester, Mass.

WAREHOUSE TRUCKS—Trucks of various kinds for use in industrial plants and warehouses are illustrated in a bulletin by the H. Zering Mfg. Co., Cincinnati, O. They range from baggage trucks to two-wheeled hand trucks, through a wide variety of uses.

GAS PRODUCERS—Gas Producer & Engineering Corp., Philadelphia, has issued a 7-page bulletin describing Galusha gas producers. The producers are mechanically operated and are said to possess many advantages over the hand stoked type.

AIR HEATERS—A 14-page booklet issued by Combustion Engineering Corp., New York, describes the use of heaters in preheating the air for combustion in industrial steam-raising furnaces. The air heaters are said to be efficient, simple in construction and easy to clean.

FURNACES—F. J. Ryan & Co., Philadelphia, have published a catalog illustrating electric, oil and gas heating furnaces. Low pressure oil and gas burners and temperature control devices are also described. The makers claim many advantages for the designs of the apparatus.

SAFE ACETYLENE PRACTICE—What to do and what not to do in handling acetylene and other gases are the subjects of a booklet by the Oxweld Acetylene Co., Chicago, which is being circulated to users. Safety codes from other sources also are recommended, to the end that accidents be eliminated.

CONVEYOR ROLLERS—A roller for gravity conveyors especially designed to withstand the severe use to which it is subjected is illustrated in a halftone bulletin by the Standard Conveyor Co., North St. Paul, Minn. Installations are shown and details of construction of the roller and its bearings are given.

SAFETY—"Maintaining Interest in Safety" is the subject of a pamphlet issued recently by the National Safety council, Chicago. The booklet is illustrated with photographs, charts, etc. and includes a list of the titles of the various motion picture films that are being distributed by the institution.

CARRIERS—Many uses and advantages of a power driven carrier are presented in an attractive 68-page book prepared by the Link-Belt Co., Chicago. iagrams and full page illustrations of various installations are included. The catalog should serve as a compendium of useful information to engineers and architects.

AIR TURBINE MOTOR—A motor impelled by air acting through a turbine member, to operate wire brushes to clean castings, scale ships and remove scale from billets in steel mills is persented in a bulletin by the Standard Turbine Corp., New York. Many advantages are claimed for this form of motor for these purposes.

VALVES AND FITTINGS—The complete line of products made by the Walworth Mfg. Co., Boston, is listed in a new catalog No. 83 just published by the company. These products include valves, fittings, tools, wrought pipe and supplies for steam, water, gas, oil and air. The new catalog is in the form of a 5½ x 7¾-inch cloth bound book containing 716 pages. The last 78 pages contain useful information and tables.

CASTINGS—Interesting facts regarding the foundry industry in the twin cities of Minneapolis and St. Paul are contained in a small folder issued by the Twin City Foundrymen's association. The growth of the twin city foundries in floor space has been from 500 square feet in 1860 to 1,250,000 square feet in 1925. The circular gives the kinds of castings made and also the list of members of the association.

PUMPS AND TURBINES—Its complete line of centrifugal pumps and steam turbines is described in a general way in a new 8-page catalog being distributed by the Dean Hill Pump Co., Anderson, Ind. Pumps and turbines for practically every service are mentioned in the catalog.

STOKERS—Side-dump stokers are discussed in a 20-page publication prepared by the Riley Stoker Corp., Worcester, Mass. Operation of the stoker is explained by numerous photographs and sketches. Typical installations are suggested by the use of blue print sketches. In the back of the bulletin is a representative list of installations.

FIRST AID—A booklet of first aid suggestions, one of a series dealing with the subject of health and safety, has been prepared by the Prudential Insurance Co., Newark, N. J., for distribution to its members and the public. Emergency treatment of various ailments together with photographs showing the proper procedure are included.

AIR COMPRESSORS AND VACUUM PUMPS—General features of machines of this type as manufactured by the Pennsylvania Pump & Compressor Co., Easton, Pa. are presented in a 24-page booklet now ready for distribution to the trade. Sectional and general views of various units in addition to tables and compressed air data are included.

TRADE ASSOCIATIONS—Recent decisions affecting trade association statistical services are presented in an eight-page pamphlet published by the National Industrial Conference board, Inc., New York. The decisions discussed refer to the cases between the Maple Flooring Manufacturers' association and the United States, and the Cement Manufacturers' Protective association and the United States.

DIE SETS—A new 34-page catalog has been issued by Danly Machine Specialties, Inc., Chicago. An illustration and blue print of each die set are provided. The knock-down die sets also are described. The catalog is arranged to be a ready reference for tool-room foremen, designers and superintendents who are concerned with die sets.

OXYACETYLENE—Answers to questions about the oxyacetylene process are given in a booklet by the Air Reduction Sales Co., New York. The information gathered into this small compass gives an unusually good insight into some of the features of this process and incidentally supplies information relative to the products of the company.

PYROMETERS—Potentiometer Pyrometers is the title of a 56-page catalog published by the Leeds & Northrup Co., Philadelphia. Numerous typical installations are shown by photograph. Automatic control equipments also are discussed at some length. Numerous charts from recording instruments are reproduced in actual size. A price list together with a 2-page discussion of the theory of the potentiometer pyrometer conclude the book.

The FOUNDRY

SELLING THE OUTPUT

The FOUNDRY

What The Industry Needs Today Is Sales Not Production

Presidents Have no Corner on the WISH TO KEEP COOL

DESIRE to prosper rules the universe. Even in far off China the word *hsin* meaning to prosper appears over 400 times in a study made by the Peking Teacher's college of 4974 advertising signboards. This word, written in the expressive Chinese character looks much like the old fashioned *caster* that stood in the center of the table, carrying the salt and pepper shakers, the vinegar cruet and a bottle of liquid damnation known as *pepper sauce.* Strangely symbolic this character for *hsin,* for even in this country some of the homely elements that make prosperity are the salt and pepper of common sense, the vinegar of experience and a fair amount of the incentive known among the erstwhile how-to-succeed speakers as *pep.* Who will deny that the one who imbibed a bit of the fire filled liquid was moved to strenuous action?

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ALL this was prompted by a newspaper item about the purchase of an $8,000,000 central western foundry and manufacturing plant by an eastern holding company in which a nationally-known, mailorder house is interested. The old firm has made buggies, automobile bodies, gas engines and more recently refrigerating machines. Significant is the fact that the holding company makes a domestic electric refrigerating machine and this speaks volumes.

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NO ONE could fail to notice during the summer that is just passed the tremendous reductions in prices offered on the domestic refrigerators using ice, nor could they overlook the growth in the variety and character of the electrical refrigerators offered either as complete units or as accessories to be adopted to the standard ice boxes. This large mail order house is awake to the stimulated demand for an iceless refrigerating unit and places itself in position to manufacture and market such devices. During the next year or two, it is reasonable to expect that the history of automobile development will be repeated. Remember the high prices that prevailed at first? Advertisements described one, two and three cylinder *runabouts,* tiller controlled with the engine under the seat and selling at upward of a thousand dollars. Further, the top, windshield, tools, and horn were extra. Then came cheaper production, wider use, lower cost and finally the dollar-down and dollar-forever plan of purchase that obtains today. Why wait? Buy the car you want today and pay when we catch you home.

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IT WILL not take the electric refrigerating machine so long to pass through the stages mentioned. The refrigerator starts in the necessity class, while the automobile had some stiff hill climbing before it arrived at that plane. Also, it costs much less. I do not believe that just any foundry could start tomorrow to make and market a home refrigerating machine and prosper in the real sense of the word, but some will use that newly opened and attractive trail. Present manufacturers of this domestic utility might do well to hang out the sign I saw on a weather beaten flivver the other day, "If you must bump me, use your head."

Phineas, Jr

P. T. Barnum Says/

YOU cannot accumulate a fortune by taking the road that leads to poverty.